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# MACHINERY

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# Sub-Zero Treatment of Steel

## *A New Departure in Shop Practice*

**The Recent Investigations into the Changes that Take Place in Steel when Subjected to Very Low Temperatures Following the Usual Heat-Treatment Open up an Entirely New Field in the Treatment of Cutting Tools and Tool Steels in General**

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LARGE numbers of reports and several articles have been written on the improved properties and performance brought about by sub-zero cooling of steel parts, particularly tools. Claims of several hundred per cent improvement in life of tools, while probably exaggerated, are not uncommon. The treatment has also been a partial cure for improper initial heat-treatment. In either case, the value of the process is unquestioned. It is likely to become a routine part of normal heat-treating practices, and sufficient authoritative information is al-

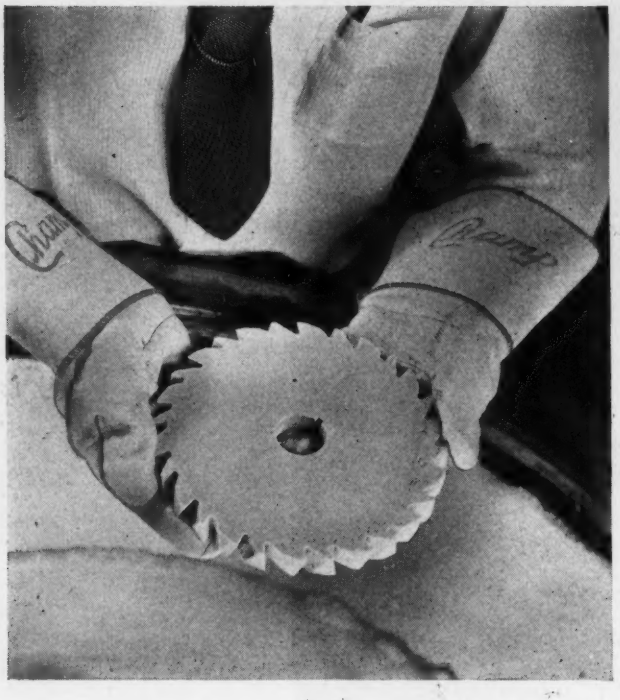


*Fig. 1. Milling Cutter of High-speed Steel being Removed from Sub-zero Chamber. This Cutter was First Oil-quenched from 2350 Degrees F., Then Tempered at 1050 Degrees F. for Two and One-half Hours, and Then Cooled to Minus 100 Degrees F. in the Sub-zero Chamber. The Milling Cutter will be Ready for Use following Another Tempering of One Hour at 1050 Degrees F.*

*Fig. 2. Hubbing Master of High-carbon High-chromium Tool Steel for Sinking Plastic Mold Die Cavities. It is First Hardened in the Conventional Manner to 65 Rockwell C.; Then Tempered in Boiling Water for One Hour; Cooled to Minus 100 Degrees F. in a Sub-zero Chamber; Warmed to Room Temperature; and Tempered at About 900 Degrees F. to a Hardness of 60 to 62 Rockwell C.*

ready available to warrant a sustained program of actual exploitation in the shop and further study in the laboratory. Therefore, a presentation of the fundamentals of cooling hardened steels to temperatures considerably below room temperature, properly correlated with the basic treatment cycle and related structural changes, should be of considerable interest.

When steel is heated to its hardening temperature, the structure consists of a solid solution of carbon in iron, known as austenite, with or without alloying elements in solution, and with or without free iron or alloy carbides, depending on the composition and temperature. Austenite is relatively soft, tough, and ductile, even at room temperature. The carbides are very hard compounds of carbon and iron or alloying elements such as chromium, tungsten, molybdenum, and vanadium. In hardening such steel by cooling in some suitable medium, the austenite transforms to martensite—a hard and strong constituent that is an aggregate of finely dispersed carbides in iron. This aggregate bears some similarity to suspensions such as colloidal graphite in water, except that the particle size in the former is much finer.

As explained in greater detail later, an ideal hardening operation would be one in which all of the austenite was transformed to martensite upon reaching room temperature. This is true even if the final hardness desired is much lower than would result from this ideal harden-

ing, for it is well known that the best physical properties are obtained by quenching (in water, oil, or air) to maximum hardness, and then tempering to the desired combination of hardness and strength relative to ductility and toughness.

### *Why Steels Do Not Always Attain Maximum Hardness*

In many steels, however, the transformation of the soft high-temperature constituent austenite to the hard constituent martensite is not always complete. In other words, after the steel has been cooled to room temperature, some austenite is still retained. This is illustrated in Figs. 3 and 4, which show isothermal time - temperature transformation curves of a high-speed steel determined by Gordon, Cohen, and Rose (1),* and an air-hardening die steel by Payson and Klein (2), respectively, on which cooling curves for standard treatments have been superimposed.†

In Fig. 3, it will be seen that oil quenching of 18-4-1 high-speed steel to room temperature transforms only about 75 per cent of the structure to martensite, while 25 per cent remains as untransformed austenite.

*The figures in parentheses refer to the bibliography at the end of this article.

†For a fundamental discussion on isothermal transformation curves, the reader is referred to studies of the subject by Davenport (3) and Grenninger and Troiano (4).

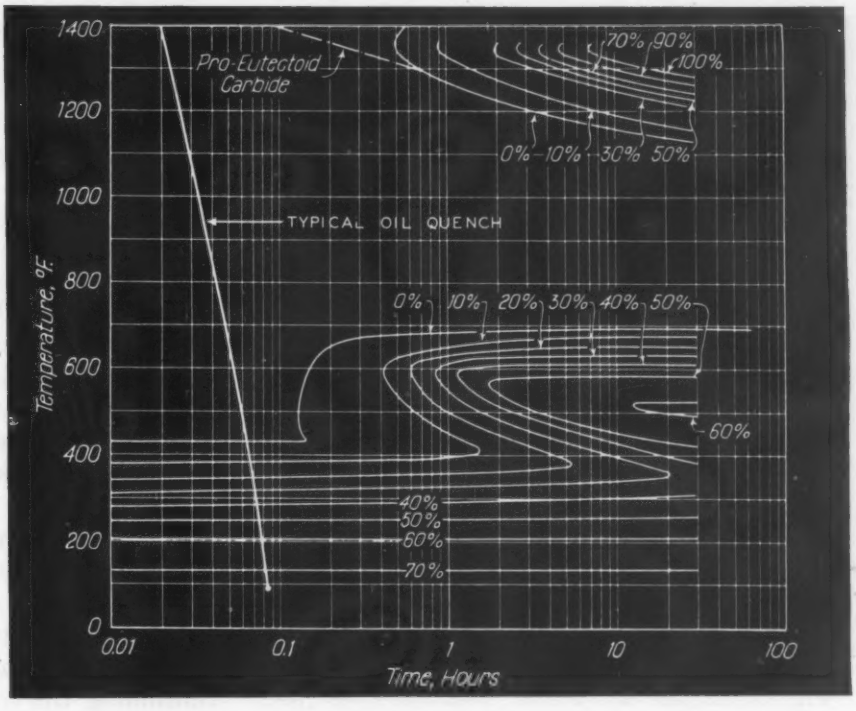
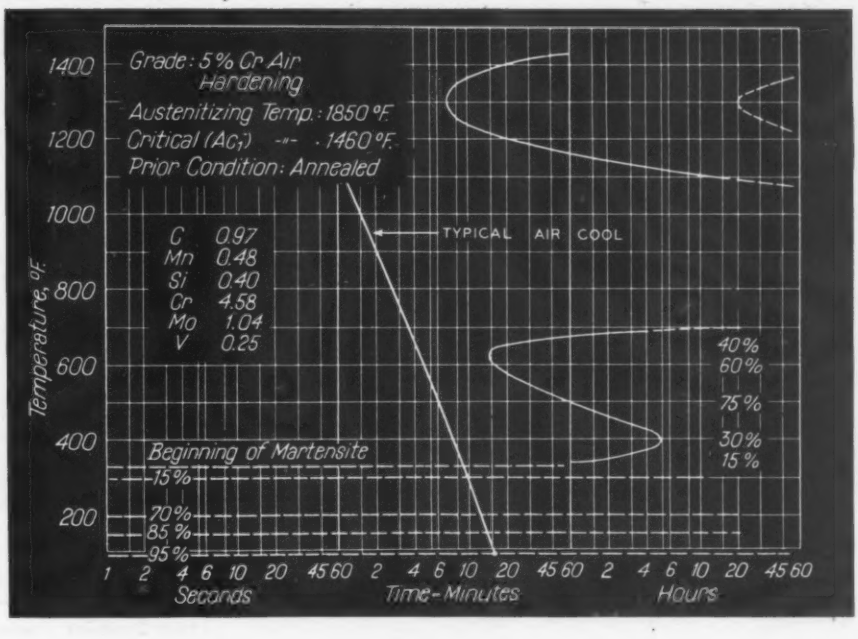



*Fig. 3. Time-temperature Transformation Curve for 18-4-1 High-speed Steel*

*Fig. 4. Time-temperature Transformation Curve for 5 Per Cent Chromium Air-hardening Steel*



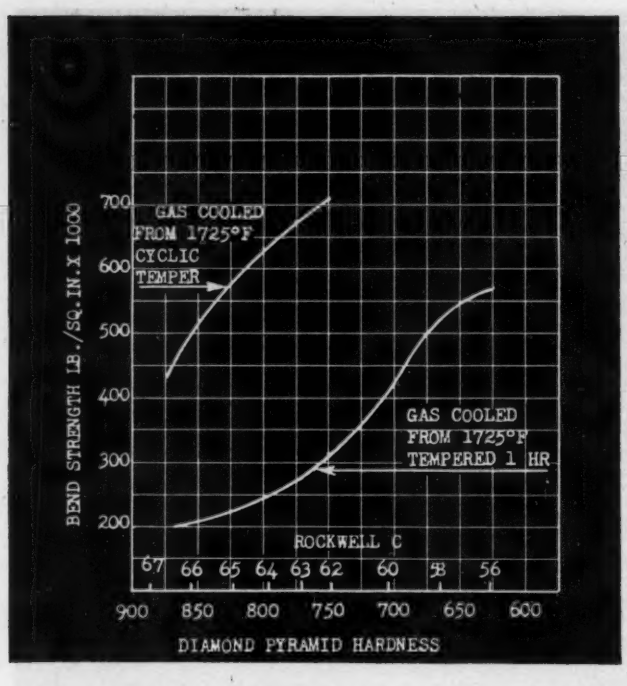



*Fig. 5. Effect of Cyclic Treatment on the Bend Strength of Air-hardening Steel Containing 1 Per Cent Carbon, 5 Per Cent Chromium, and 1 Per Cent Molybdenum*

Fig. 4 shows that about 5 per cent of austenite remains in the chromium air-hardening steel after cooling in air to room temperature.

Many other steels retain austenite in a similar manner, provided the cooling is sufficiently rapid to prevent transformation at a high temperature to a relatively soft product—pearlite. The cooling rates of the steels in Figs. 3 and 4 could be reversed and the amount of austenite retained in each case would be about the same. K. Honda and K. Iwase (5) have shown that more austenite *may* be retained by oil quenching than by water quenching, probably due to the greater thermal stress produced by the latter. It is believed that the same phenomenon exists in higher alloy steels when air or oil quenched.

It is impossible to give a specific rule, but it may be generally said that the higher the carbon and alloy content and the higher the hardening temperature, the greater will be the tendency to retain austenite. Thus, it is apparent that mixed structures of this nature may be present frequently in "as quenched" steel.

### *Transforming the Retained Austenite*

The transformation of retained austenite can be effected in a number of ways. In a few steels, in which the amounts of retained austenite are relatively small, a sufficient length of time (sometimes months or years) at room temperature will change all or nearly all of it to martensite. This, of course, is frequently disadvantageous, particularly in the case of dies and gages, because full hardness and dimensional stability are not obtained at once. This explains the inability of many gages to maintain their shape and size accurately over a long period of time. In all steels, the austenite can be transformed by tempering; but, frequently, such high temperatures are required as to lose the hardness of the martensite and cause transformation of the austenite to a softer product—bainite.

Referring again to Figs. 3 and 4, it is obvious that the austenite can be transformed by simply continuing the cooling of the steel to considerably below room temperature. Gordon and Cohen (6) have shown how such treatment reduces the stability of the retained austenite—that is, reduces its reluctance to transform.

In many plain carbon and low-alloy steels, either medium- or high-carbon (including carburized steel), one such cooling to a temperature of minus 100 degrees F. is sufficient to virtually complete all transformation. In other steels, particularly the highly alloyed die steels, several

Effect of Tempering 18-4-1 High-Speed Steel at 1050 Degrees F.

| Time of Exposure to Tempering Temperature | Hardness, Rockwell C | Transverse Strength, Pounds per Square Inch | Torsion Impact, Foot-Pounds | Hot Hardness,* Rockwell C |
|---|---|---|---|---|
| Single Tempering | | | | |
| 6 minutes | 65.1 | 312,000 | 16 | 55.0 |
| 1/2 hour | 65.7 | 270,000 | 30 | 57.0 |
| 2 1/2 hours | 65.0 | 408,000 | 48 | 58.0 |
| 5 hours | 64.5 | 410,000 | 48 | 57.0 |
| 24 hours | 63.8 | — | 39 | 55.0 |
| Double Tempering | | | | |
| 2 1/2 hours plus 2 1/2 hours | 64.5 | 454,000 | 63 | 57.0 |

*Hot Hardness measured at 1000 degrees F.

such operations may be necessary, with intermediate tempering between each sub-zero treatment. In fact, high-speed steel must be tempered in the conventional manner at least once during the heat-treatment cycle in order to obtain transformation of all of the austenite.

### *Value of Sub-Zero Treatment of Steel*

Now that it has been determined how an austenite-free structure can be obtained, the question may be asked, Is it worth while to go to all this trouble? It is well known that, from the mechanical property standpoint, the amounts of retained austenite and untempered martensite should be at an absolute minimum in the final product. Repeated tests by Cohen and his coworkers (6, 7) have indicated higher strength and toughness without appreciable loss in hardness when all the austenite has been transformed by tempering or sub-zero treatment, especially the latter, and this is particularly true when the completely transformed structure is given a final temper for stress relief.

H. Scott and T. H. Gray, metallurgical section engineer and consulting metallurgist, respectively, Westinghouse Research Laboratories, have shown (see Fig. 5) a more than 200 per cent increase in transverse bend strength over a considerable range in hardness by a cyclic treatment after hardening. This consisted of alternately tempering in boiling water and cooling to minus 100 degrees F. three times, followed by a final temper to the desired hardness. Evidence has been offered in the case of high-speed steel showing that all of the austenite can be transformed by tempering one or more times at the usual temperature (1050 degrees F.) followed by cooling to room temperature after each heating. The amount of austenite that will be transformed is dependent on the length of time the steel is exposed to the tempering temperature; the effect of the progressively reduced amounts of austenite on the properties of the steel is shown in the accompanying table [Cohen (8)].

The effect of these improved properties has been substantiated by actual shop results, where reduced breakage and edge chipping, longer cut-

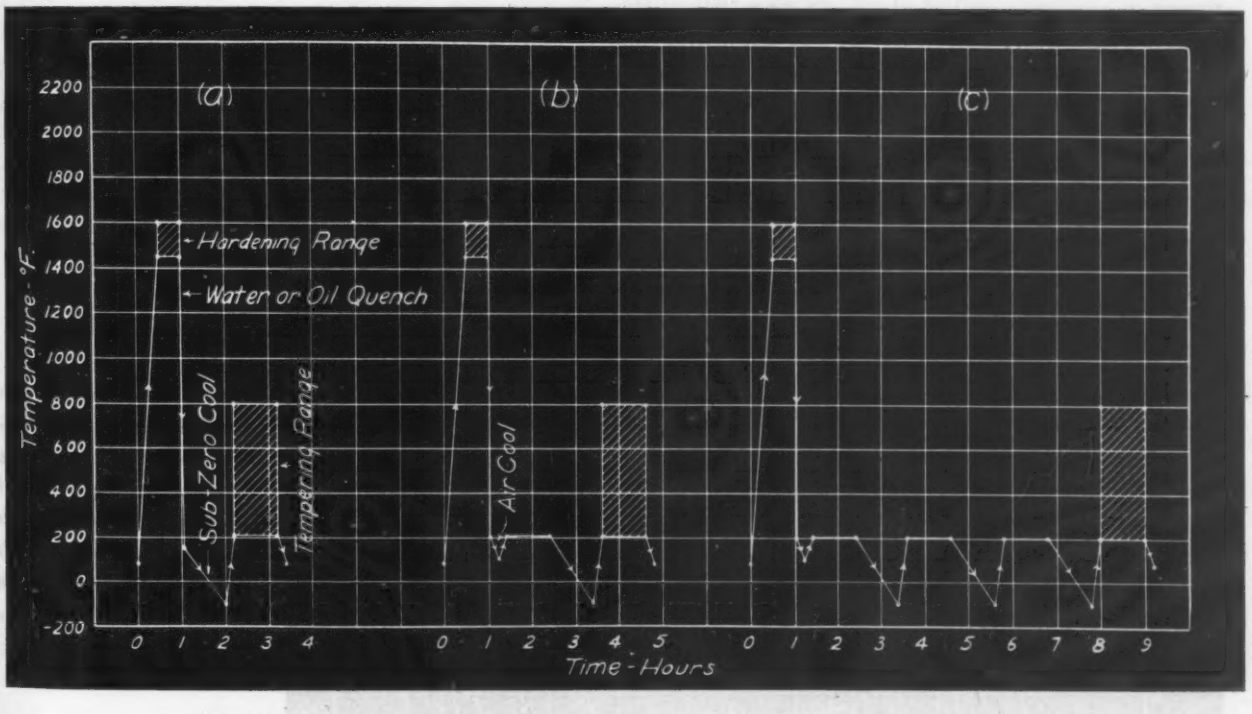



***Fig. 6. Cycles in the Heat-treatment and Sub-zero Treatment of Water- and Oil-hardening Tool Steels and Alloy Carburizing Steels***

ting life, and more blanks per grind have all been obtained.

As previously pointed out, it is usually desirable to have the transformation take place at relatively low temperatures (under 300 degrees F.). This necessitates a note of caution, since steels containing considerable proportions of austenite are provided with a "cushion" of high plasticity for the accommodation of considerable stress. If this "cushion" is removed, particularly at very low temperatures where plasticity in general is quite low, stresses resulting from natural dimensional changes will occur, which connotes a serious cracking hazard. With these facts in mind then, an approach to the practical application of sub-zero treatments can be made.

### *Application to Different Types of Steel*

For carbon or moderately alloyed steels of medium carbon content, such as S A E 1045, 4140, 4340, and NE equivalents, the practical value of sub-zero cooling is questionable, because the amounts of retained austenite are either nil or relatively small. Furthermore, in most engineering applications of steels of this type, the tempering temperatures are fairly high and the hardness considerably reduced, so that the conversion of the austenite to bainite would not be objectionable. Bainite, untempered or tempered, is known to have excellent properties for applications that do not require maximum hardness.

For water- and oil-hardening tool steels, alloy carburizing steels, and other low-alloy high-carbon steels such as S A E 52100, the treatment has been found frequently beneficial. Typical cycles are illustrated in Fig. 6. In general, cycle (a) is satisfactory for virtually all alloy carburizing steels and, in some cases, for other steels as well. Cycles (b) and (c) offer considerably reduced danger of cracking, particularly in cases where there are sharp corners or edges or where the part has hardened throughout the cross-section. Cycle (c) is especially advantageous for gages, since it offers the greatest degree of stabilization. In all cases, the final temper is the last operation, and this is true of all subsequent treatments discussed.

The curves indicate actual steel temperature. While the time relationships are not intended to be exact (except where specifically stated), it is significant to note that it is not deemed necessary to hold the steel at the sub-zero temperature for any appreciable length of time; but it is important that the steel reach the temperature given.

### *High-Alloy Die Steels*

Treatments for the highly alloyed die steels, as shown in Fig. 7, are very similar, except that two, and sometimes more, immersions in the sub-zero cooling medium are necessary to obtain op-

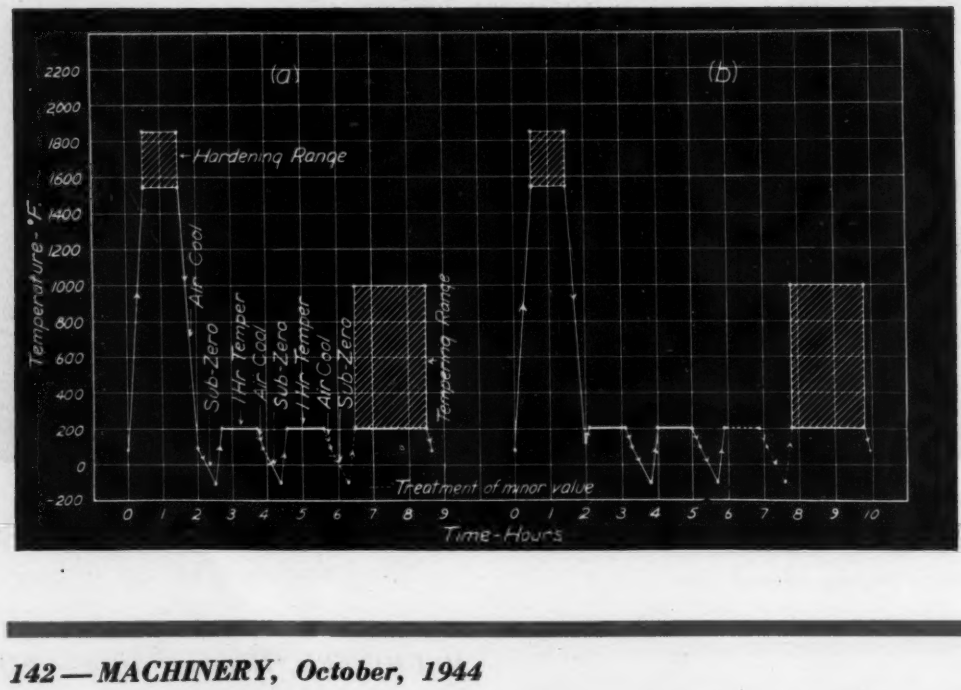



*Fig. 7. Cycles for the Treatment of Chromium-molybdenum, Manganese-chromium-molybdenum, and High-carbon High-chromium Air-hardening Tool Steels*

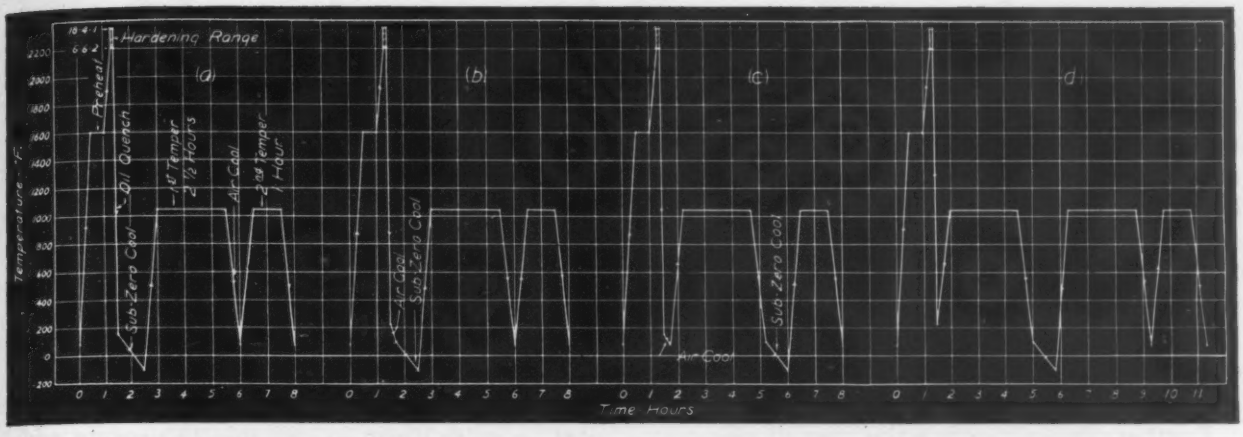



*Fig. 8. Cycles in the Heat-treatment and Sub-zero Treatment of High-speed Steels*

timum properties, since the austenite is considerably more sluggish—that is, resistant to transformation. Somewhat inferior properties probably result from cycle (b), as against cycle (a), due to "aging" (subsequently explained in the discussion on high-speed steel). Cycle (b) does, however, offer greater freedom from the cracking hazard.

Since steels that have been sub-zero treated have considerably greater strength at a given hardness, tools made from them can be used at higher hardness than those subjected to ordinary heat-treating practice. By the same token, if breakage in service had been a serious problem previously, tempering to the same hardness as used with conventional treatment would produce much greater toughness.

### *Application to High-Speed Steel Tools*

Fig. 8 illustrates several cycles for the treatment of high-speed steel. The regular salt bath technique can also be employed, the only difference being that the steel is air-cooled following the customary quench in a salt bath held at a temperature of approximately 1100 degrees F. High-speed steel, however, because of some anomalous behaviours, requires additional explanation. Cycles (a) and (b) are of equal effectiveness, and would seem most likely to produce the best results in performance of all the heat-treatments given. It should be pointed out, however, that this is not definitely established. Berlien (9) and DePoy (10) have obtained opposing results in independently conducted service tests. Cohen (8) reported, however, that beneficial results have been obtained by sub-zero treating of *finished* tools, which seems to indicate an effect or factor that has not yet been explained.

It will be noted that, even when the cooling is more or less continuous from the quench to the sub-zero temperature, double tempering is recommended. Cohen (6, 8) has shown this to be because the first cooling still leaves approximately 9 per cent of the austenite untransformed, and no amount of time or a lower temperature will appreciably alter this condition. According to Cohen and Koh (11), it is, therefore, necessary to "condition" the remaining austenite by the first temper, so that it will transform on cooling to room temperature. Of course, it is desirable to stress-relieve this last formed martensite to obtain the best properties; hence, the second temper.

It is appreciated that many tools, particularly large ones of complicated section and those containing sharp corners or edges, would be prone to crack if given either treatment (a) or (b). Hence the treatments shown by cycles (c) and (d) are suggested. These may not produce properties equal to cycle (a) or (b), as pointed out previously, but the improvement over conventional practice is considerable; and they do provide a means of treating shapes that would be certain to distort or crack if they were sub-zero cooled directly.

### *Some General Precautions*

In carrying out any of the treatments illustrated, the steel should not be held at or near room temperature for any appreciable length of time before sub-zero cooling, since the austenite becomes stabilized through an "aging" phenomenon, and thereby becomes increasingly difficult to decompose. Gordon and Cohen (6) have shown that holding for as short a time as one hour has a detrimental effect, and ten hours reduces the efficiency of the sub-zero treatment 50 per cent.

Furthermore, arresting the quench above approximately 225 degrees F. is not recommended, since a majority of the austenite would not be transformed until the steel was cooled from the tempering temperature, with an even greater hazard of cracking. Specific tempering times are given for high-speed steel, because they are of considerable importance. According to Cohen (8), the first temper, if less than two and one-half hours at 1050 degrees F., will not permit sufficient precipitation of carbides at the tempering temperature to allow for complete transformation of the retained austenite on cooling, while more than three hours causes some loss in both room temperature hardness and hot hardness, strength, and toughness.

In conclusion, it is felt desirable to add some further precautions that have been dictated by actual experience. Since the distortion and cracking hazard is ever present in transforming austenite to martensite at such low temperatures, it is desirable that the temperature of the part be as uniform as possible to prevent additional thermal stresses. Many users of the process have, consequently, employed the practice of surrounding the part with one or more layers of heavy wrapping or asbestos paper before insertion in the cooling medium to slow up the cooling somewhat. Users are also cautioned to avoid making hardness tests, particularly with heavy indenters, until the part has been tempered.

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# Recent Advances in Making Aluminum-Alloy Forgings

## Procedure in Making the Dies, Selecting the Alloy, and Performing the Forging and Heat-Treating Operations Required to Produce Aluminum Forgings of Specified Characteristics

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THE production of aluminum-alloy forgings is a relatively new industry. Much of the technique employed in this work has been developed quite recently by American engineers. Only five years ago, the proportion of aluminum used for forging purposes in America was less than 2 per cent of the total amount produced. Today, about 12 per cent of the aluminum we produce is going into forgings, and the proportion is still rising.

Well made aluminum-alloy forgings are strong and dependable. These advantages, combined with the inherent lightness of aluminum, have created a great demand for aircraft parts forged from this material. Forgings made from aluminum alloys are also needed for other products of great importance in America's war production program. As a result of this demand, numerous companies that have had no previous experience in producing aluminum-alloy for-

gings have suddenly found themselves engaged in this business. It is the purpose of the present article to give a general outline of the fundamental principles involved in producing aluminum forgings.

While the forging of steel and the forging of aluminum are fundamentally similar operations, many of the details are different. Die design, stock preparation, choice of alloys, lubrication, heat-treating, forging temperatures, tolerances, and the like must be controlled to suit the characteristics of aluminum.

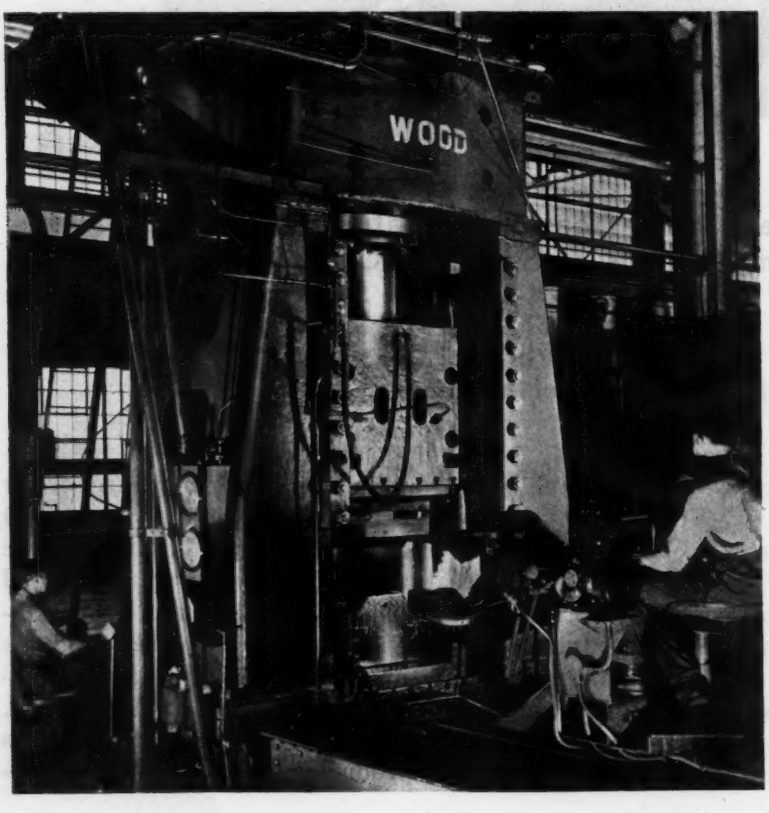
### *Type and Design of Forging Dies Employed*

Dies for small-hammer forging may include various components known as the fuller, edger, bender, blocker, and finish impression. The fuller and edger are used to rough-shape and draw out the metal, after which any necessary bending is done, so that the metal is of such shape and size that it can be made to fill the blocking die completely. The blocker should be designed so that the metal will flow easily to the various parts of the die. The finish impression die must have well defined radii and corners in order to bring the forging to exact shape and size. Some forgings, for obvious reasons, will not require all of the production steps outlined.

Table 1. Thickness Tolerances for Drop-Hammer Forgings

| Net Weight, Pounds | Tolerance, Inch | |
|---|---|---|
| | Minus | Plus |
| 0.000 to 0.25 | 0.010 | 0.032 |
| 0.251 to 1.00 | 0.015 | 0.032 |
| 1.010 to 4.00 | 0.032 | 0.045 |
| 4.010 to 17.00 | 0.032 | 0.062 |
| 17.010 to 24.00 | 0.032 | 0.078 |
| 24.010 and up | 0.032 | 0.093 |

Proper draft allowance is an important consideration in designing forging dies; and when the final shape of the forging fails to provide a natural draft, provision must be made for a draft of about 5 to 7 degrees for hammer forgings. For press forgings, a somewhat smaller draft angle is sufficient, from 2 to 5 degrees




*Using an Electric Manipulator for Handling an Aluminum Billet that is being Shaped in a Large Hydraulic Forging Press*

being usual practice. For upset forgings, the nominal angle generally used is 1 degree. These allowances apply to both outside and inside holes and depressions. Shrinkage and mismatch tolerances are also important, and should be calculated according to the figures given in Tables 2 and 3.

The metal most frequently employed for forging dies is an alloy steel containing 1.00 to 1.50 per cent nickel, 0.80 to 1.10 per cent chromium, 0.50 to 0.60 per cent carbon, and 0.25 to 0.50 per cent molybdenum. It should be normalized, tempered, and drawn to a hardness of about 40 Rockwell C. A harder steel is used for die-blocks that are to be employed on upsetters and forging presses.

Separate die-blocks are usually necessary for the blocker and the finish impression when large forgings, such as crankcases, are to be fabricated. The production of sharp, clean, well filled forgings depends considerably upon the design of the blocking die, which can otherwise be responsible for such forging imperfections as cold shuts. As little flash as possible should be produced; die design and stock size will determine this. Proper grain flow should also be established by the die designer where it is important that the final forging have high strength in certain directions.

Table 2. Shrinkage Tolerances for Aluminum Forgings*

| Length or Width, Inches | Shrinkage Tolerance, Inch | |
|---|---|---|
| | Plus | Minus |
| 1 | 0.004 | 0.002 |
| 2 | 0.008 | 0.004 |
| 3 | 0.012 | 0.006 |
| 4 | 0.014 | 0.008 |
| 5 | 0.020 | 0.010 |
| 6 | 0.024 | 0.012 |
| For each additional inch, add | 0.004 | 0.002 |

*In designing a forging, metal should be added to take care of shrinkage and mismatch. Calculation of tolerances for shrinkage and mismatch must be made in conjunction with each other; never as the sum of the two. Whichever of these factors requires the greater allowance in a given direction should govern.

Table 3. Mismatch Tolerances for Aluminum Forgings

| Net Weight of Forging, Pounds | Mismatch Tolerance, Inch |
|---|---|
| Up to 2.500 | 0.015 |
| 6.250 | 0.018 |
| 8.500 | 0.021 |
| 15.000 | 0.024 |
| 20.000 | 0.028 |
| 25.000 and up | 0.032 |

Table 4. Maximum Forging Temperatures for Aluminum Alloys

| Alloy | Temperature, Degrees F. |
|---|---|
| 14S | 840 |
| 17S | 840 |
| 18S | 820 (Upsetter 880 to 900) |
| 25S | 860 |
| 32S | 800 (Upsetter 880 to 900) |
| A51S | 880 |
| 53S | 880 |
| 70S | 840 |
| 73S | 820 |

### *Thickness Tolerance*

A small thickness tolerance is required for hammer forgings. The allowance should be applied to the over-all depth of the forging in a direction perpendicular to the parting plane and parallel to the direction in which the ram travels. The thickness tolerance varies with the weight of the forging, as shown in Table 1. It is usually necessary to use a complete cold-restriking or coin-pressing operation if tolerances closer than those indicated are required. Thickness allowances must be applied independently of all other tolerances.

### *Shrinkage and Mismatch Tolerances*

Faulty alignment of the top and bottom dies in a forging hammer or press will cause "mismatch." The contraction of the forging upon cooling produces shrinkage. In designing a forging, the dimensions of the die cavity must be made to compensate for this factor. Tolerance calculations for shrinkage and mismatch, as indicated in Tables 2 and 3, should be made in conjunction with each other, and should never be the sum of the two. Whichever factor requires the greater allowance in a given direction should determine the tolerance. If extra stock

is required for subsequent machining operations, these allowances should be in addition to mismatch and shrinkage tolerances.

### *Selection of Forging Alloys*

The various aluminum alloys suitable for forging present a number of advantageous combinations of machinability, low expansion, and high strength at elevated temperatures, resistance to corrosion, forgability, and other properties. The right alloy for a given forging job will be apparent after careful consideration is given to the fabricating problems involved and the final use to be made of the forged product.

Of the aluminum forging alloys, 17S and 14S are the most widely used for fittings in aircraft construction and in other structural applications where high physical properties are required. Even in seaplanes, these alloys have shown entirely satisfactory resistance to corrosion. Both alloys are readily machinable. The mechanical properties of 14S are higher than those of 17S, and for that reason 14S is used where the maximum in weight saving is required. Aluminum alloy 53S is also frequently employed when maximum resistance to corrosion is of greater importance than high mechanical properties. The resistance of aluminum alloy 25S to corrosion is lower than that of 17S, but its mechanical properties are similar and it is easier to forge into intricate sections that must be forged at higher temperatures.

Alloys 18S and 32S are recommended when the forged product will be required to retain high strength at elevated temperatures (as far as possible), as is the case with automotive and aircraft pistons. Alloy 32S has a relatively low coefficient of expansion, which is an important consideration in pistons and like parts.

Good-sized forgings, such as crankcases for radial aircraft engines, usually are made from alloy A51S, since forgings of this type would present difficult manufacturing problems if harder alloys were used. Production time is also reduced through the use of A51S for large

*Die-sinker Engaged in Polishing the Surface of a Forging Die*

*Lowering Aluminum Aircraft Propellers into Heat-treating Furnace*

forging jobs. The life of forging dies is increased, and closer tolerances on finished parts are possible because the A51S alloy flows readily under the forging hammer.

Under certain conditions, alloys 2S and 3S may be selected for forgings because of their low cost of production, good welding characteristics, and resistance to corrosion. Their greatest use is for small press forgings in applications where mechanical property considerations are of no concern. Alloy 11S is suitable for forgings when subsequent machining of the product is necessary.

### *Preparation of Stock for Forging Operation*

Forging stock is either rolled or extruded rod, rolled slab, or cast ingot. The metal flow of rolled or extruded stock is in the direction in which the metal has been pre-worked, and care should be taken in preparing the stock to retain the most advantageous grain flow at points where the greatest stress will be borne in the final forging. Consideration of grain flow is also an important factor in designing dies.

The most economical billet size for production of the particular forging must first be determined. Cutting of stock to correct billet size may be done by one of several methods. A band saw is satisfactory and quick for some jobs, but produces a rough surface and is not recommended if the finish of the cut face is of importance. Stock that is no more than 2 3/4 inches thick may be cut to length in a shear. Where the smoothest possible finish is desired (as where the cut end will finally become a considerable part of the finished forging's surface), stock should be cut with an abrasive wheel or a high-speed circular saw.

Table 5. Data on Heat-Treatment and Aging of Forgings

| Alloy | Heat-Treating Temperature, Degrees F. | Time Required for Treatment, Hours | Aging Temperature, Degrees F. | Time Required for Aging, Hours |
|---|---|---|---|---|
| 14ST* | 930 | 10 to 12 | 340 | 10 to 12 |
| 17ST | 940 | 10 to 12 | Room Temperature | 72 |
| 18ST | 960 | 10 to 12 | 340 | 12 to 20 |
| 25ST† | 960 | 10 to 12 | 340 | 12 to 15 |
| 32ST | 930 | 10 to 12 | 340 | 10 to 15 |
| 51ST | 960 | 10 to 12 | 340 | 8 |
| A51ST | 960 | 10 to 12 | 340 | 8 to 10 |
| 70ST | 960 | 5 to 8 | 340 | 10 |
| 73ST | 960 | 8 to 10 | 340 | 8 to 10 |

*For maximum hardness and tensile strength, age twelve hours at 340 degrees F.

†Heat-treat propellers twelve hours and age a minimum of fifteen hours.

*Another Delicate Operation in Sinking Dies for Aluminum Forging*

In the production of large forgings, the billet is frequently made from a cast ingot. The ingot, in these cases, is worked into preliminary wrought form by a hydraulic press or under an open-frame hammer. Presses with capacities ranging from 1500 to 3000 tons are used for this operation. It should be kept in mind that the distance of the squeeze in the press is limited by the die corner radii, which should be 4 inches or more.

After the aluminum-alloy stock has been properly prepared, it is ready for heating to a suitable forging temperature. Special care

Table 6. Mechanical Properties of Aluminum-Alloy Forgings

| Alloy | Minimum Specification Values | | | | Typical Values (Not Guaranteed) | | |
|---|---|---|---|---|---|---|---|
| | Yield Strength* (Set = 0.2 Per Cent), Lbs. per Sq. In. | Ultimate Strength† (Tension), Lbs. per Sq. In. | Elongation, Per Cent in 2 Inches* | Brinell Hardness† (500-kg. Load 10-mm. Ball) | Shearing Strength, Lbs. per Sq. In. | Endurance Limit (Fatigue), Lbs. per Sq. In. | Density, Lbs. per Cu. In. |
| 11ST | 34,000 | 55,000 | 12.0 | 90 | 31,000 | 13,000 | 0.101 |
| 14ST | 50,000 | 65,000 | 10.0 | 125 | 45,000 | 16,000 | 0.101 |
| 17ST | 30,000 | 55,000 | 16.0 | 100 | 36,000 | 15,000 | 0.101 |
| 18ST | 40,000 | 55,000 | 10.0 | 100 | ..... | 14,500 | 0.103 |
| 25ST | 30,000 | 55,000 | 16.0 | 100 | 35,000 | 15,000 | 0.101 |
| 32ST | 40,000 | 52,000 | 5.0 | 115 | 38,000 | 14,000 | 0.097 |
| A51ST | 34,000 | 44,000 | 12.0 | 90 | 32,000 | 10,500 | 0.097 |
| 53ST | 30,000 | 36,000 | 14.0 | 75 | 24,000 | 11,000 | 0.097 |
| 70ST | 40,000 | 50,000 | 16.0 | 85 | 37,000 | 21,000 | 0.105 |

*These properties apply to forgings up to 4 inches in diameter or thickness. Long axis of test specimen taken parallel to direction of grain flow.

†Tension and hardness values determined from standard 1/2-inch diameter test specimens. Values in compression at least equal to values in tension.

should be taken to see that the working temperature of the metal does not at any time rise above the specified maximum, if "burning" is to be avoided. Overheating will result in blistered or cracked forgings. It is often desirable to work aluminum alloys at temperatures somewhat lower than the maximum to which the alloy can be heated without damage. Heating limits for the various forging alloys are shown in Table 4.

### *Lubrication of Dies*

Lubrication of the dies used in forging operations is necessary to prevent excessive sticking of the metal to the dies. Several types of lubricants are employed, the most popular of which are salt water, graphite in oil, and molten beeswax. The cost of beeswax prohibits its general use for routine operations unless there is a considerable advantage to be gained. Because of its splendid characteristics in promoting ease of operations, however, it is used when possible in the production of press forgings.

### *Heat-Treatment of Forgings*

All aluminum-alloy forgings must undergo suitable heat-treatment after the forging operations in order to obtain their maximum properties. Briefly, this heat-treatment consists of two steps: First, a high-temperature solution treatment, in which as much as possible of the hardening constituents is brought into solid solution in the aluminum matrix. This is followed by a quench sufficiently rapid to retain these constituents in solution. The second step of the treatment is called "aging," and consists of the precipitation of finely divided particles of dissolved constituents. This may take place either at room temperature or at some elevated temperature, depending upon the alloy. Data on heat-treatment and aging of forgings is given in Table 5. The mechanical properties indicated in Table 6 are obtained in the various alloys after receiving these heat-treating operations.

* * *

## Machine Tool Shipments and Orders

Shipments of machine tools in July—the last month for which complete statistics are available—were valued at approximately $34,000,000, according to the Tools Division of the War Production Board. This is at an annual rate of somewhat over $400,000,000. The value of net new orders for machine tools placed during July—that is, total new orders less cancellations—amounted to $33,225,000, or at an annual rate of almost exactly $400,000,000. The backlog of unfilled orders at the end of July amounted to $195,000,000, equivalent to almost six months business at the rate of July shipments.

# Automatic Drum Type Fixture Speeds up Drilling Work

By C. R. PHIFFER
Transmitter Manufacturing Division
General Electric Co., Schenectady, N. Y.

TWENTY pieces per minute, as compared to four by the old method, are produced with a drum type fixture devised for drilling large quantities of small aluminum supports at the General Electric's Schenectady Works. The support is 1/4 inch square, 2 3/16 inches long, and is made of solid bar stock. It has an 8–32 tapped hole, 1/2 inch deep, in one end at the time it is ready for the drilling operation, which consists of drilling a No. 29 drill size hole at a 90-degree angle through the piece at a distance of 2 inches from the tapped end.

A revolving drum type fixture is combined with a universal drill jig, as shown in Figs. 1 and 2, to position and hold the pieces for drilling. The pieces are hand-fed into slots machined in the outer surface of the drum. There is a pin at the base of each slot over which the tapped hole in the end of the piece is placed. This arrangement serves to locate the piece properly and hold it in place as the drum is revolved.

The universal drill jig is operated by a hand-lever, and is geared to the fixture in such a way as to cause the drum to index each time the jig head is raised for placing the next piece in the drilling position. The indexing movement also

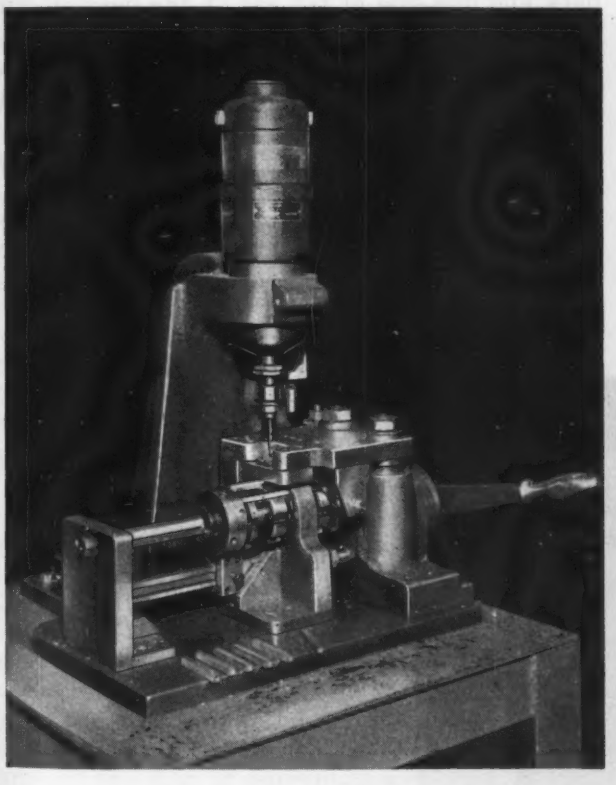


*Fig. 1. Automatic Drum Type Drilling Fixture with Clamp Holding Work in Place for Drilling*

*Fig. 2. Drum Type Fixture Shown in Fig. 1, in the Open Position with Work Located in Drum*

carries the piece just drilled toward a knock-out pin which causes it to drop through a slot in the table into a chute leading to a tray.

When the jig head is lowered, an arm attached to it operates a limit switch, causing the self-contained automatic drilling unit located above the piece to feed the drill down into the work. At the same time, a part of the jig head comes into contact with the piece, holding it firmly in place during the drilling operation.

The pieces to be drilled are placed in a tray at the left of the operator, within easy range of his left hand. The operator picks up and positions the pieces with his left hand and operates the hand-lever controlling the entire apparatus with his right hand.

The numerous advantages afforded by this fixture include full automatic drilling, which minimizes work spoilage and tool wear; and provision for opening and closing the fixture and jig, feeding in and indexing of drilling unit, and disposing of drilled pieces—all in one movement of an easily operated hand-lever, which tremendously reduces the operation time. The fixture can be adjusted to accommodate pieces ranging from 2 to 8 inches in length.

## Ingenious Fixture Facilitates Grinding Operation

A FIXTURE designed for accurately holding bearing caps from the previously ground half-bearing while ears on the caps are ground on both sides is shown in the accompanying illustration. The operation is performed at the plant of the Axelson Mfg. Co. in Los Angeles, Calif., on an Abrasive surface grinder. The fixture has a half-round mandrel under which the bearing cap is slipped. When the lever on the front of the fixture is released, a spring-actuated plunger is freed to push the bearing against the mandrel. The operator then lays a gage across the top of the mandrel and the edges of the bearing caps to make sure that the work is correctly positioned. A gage is also inserted between a block that is built into the fixture at the back and one side of the ear on the bearing cap for properly locating the work crosswise.

After the part has been located in this manner, a clamping member at the right-hand end of the fixture is swiveled to advance clamping fingers against one side of the part for locking securely against the fixture on the opposite side. Three hardened and ground strips extend lengthwise along the mandrel to insure long life of the locating surfaces.

*Ingenious Fixture Devised to Facilitate the Grinding of the Ear on Inner Cylinder Bearing Caps*

# Electronic Controls for Resistance Welding

**Third in a Series of Articles on the Fundamentals of Electronics and the Ways in which Electronic Devices can be Applied in the Mechanical Field**

By HOLBROOK L. HORTON

IT has been said that no single industrial application of electronics has contributed more to the war effort than that responsible for controlling the flow of electric power to resistance welding machines. Certainly, resistance welding, itself, has been an invaluable war production process, and in the field of aircraft construction particularly, its widespread application has been largely due to the accuracy of current volume and timing control that electronic devices have made possible.

Resistance welding depends upon the heat generated by the passage of an electric current through the parts to be welded. The character of the material, its thickness and surface condition, and the area of contact between the two parts to be welded are all factors in obtaining a successful weld. To match these factors, the amount of current, the length of time the current is permitted to flow, and the amount and duration of pressure imparted by the electrodes must be precisely adjusted and controlled for repeated operations. Electronic devices are peculiarly suited for this job.

The simplest electronic control used in resistance welding serves as a contactor to open and close the power circuit. The tubes usually employed for this purpose have a mercury pool cathode and are called ignitrons. (In some cases where only a small welding current is required, thyratron tubes may be used.) As outlined in the first article of this series (published in May MACHINERY), ignitrons are rectifying tubes and pass current only in one direction.

A pair of these tubes is used, not as a rectifier, but as a single-pole switch which will permit alternating current to flow when the circuit is closed. In order that they may perform this function, these two tubes are connected in reverse parallel, as shown in Fig. 1. The alternating current passes through one tube in one direction and back through the other tube when the direction of current flow reverses. The copper-oxide rectifiers shown in the diagram prevent the flow of current through the ignitor of each tube in the wrong direction, that is, from mercury pool to the ignitor.

Some advantages of the electronic over the mechanical contactor are greater speed of operation, absence of noise, and elimination of contactor maintenance. Ignitrons are available in sizes ranging up to those that handle currents of 10,000 amperes for short weld periods and operate at rates up to 600 times per minute.

### *Method of Controlling Heat Generated at the Weld*

When the ignitron contactor is operated without other controls, all the current from the supply line is delivered to the welding transformer primary; hence full current is induced in the secondary and passes through the work to form the weld. When different materials or parts of different thicknesses are to be welded, some means of controlling the current flow, and consequently the heat generated at the weld, must be provided. Since the heat generated at the weld varies as the square of the current passing through the weld, the current flow must be controlled very closely.

This can be done electronically by a device that delays the ignition of the power contactor tube, so that only part of each alternating-current wave is passed along to the transformer, as shown in the diagram Fig. 2. The device, called a "phase shift control," consists essentially of a pair of thyratron tubes, which are placed in series with the initiating or starting switch. (This is the switch that, in the simplest control just described, closes the ignition circuit of the ignitron power contactors.) The voltage applied to the grids of these thyratron tubes is controlled in such a way that their firing (passing of current) is delayed during each half cycle. In this way, the current passing through the igniting circuit of the ignitron tubes is delayed.

Thus, the firing of the ignitron tubes can be made to start at any point along the current wave and only a part of this wave allowed to flow through the primary of the welding transformer. The current passing through the secondary of the welding transformer is reduced proportionately, and consequently the heat generated at the weld is reduced. A single dial permits stepless adjustment of the phase shift control, and hence of the heat supplied to the weld throughout a range of 20 to 100 per cent of full heat. This use of an electronic heat control practically eliminates the need for a cumbersome auto transformer or primary tap switches.

### *Non-Synchronous and Synchronous Timing Control*

The timing control of resistance welders can be either non-synchronous or synchronous. The contacts are connected to the ignitron circuit at the point shown in Fig. 1. When the electronic or magnetic contactor closure of the power circuit is at random, the control is termed non-synchronous. This random closure may be through the use of any control device, such as mechanical timers, simple electronic timers with a control relay, or foot switches, the operation of which does not take place in a definite time relation to the supply voltage wave.

The use of a non-synchronous control often results in what is called a transient condition in the welding circuit, causing a momentary high current flow. If the weld is of short duration, say less than six cycles (a cycle being 1/60 second), this momentary high current flow may seriously affect the quality of the weld. When the welds are of relatively long duration, transient currents are not of great importance, so that non-synchronous control may be employed, as in the multiple spot-welding of the automobile body shown in Fig. 3.

With a synchronous timing control, the power circuit is closed and opened at the same point on the voltage wave for every weld. Thus, high transient currents are avoided and more consistent weld quality is maintained. This type of timing control is used particularly where short-time welds of the highest quality and surface appearance are required, and where metals, such as aluminum, brass, and stainless steels, with critical weld characteristics are employed.

The three basic electronic control units for resistance welding are, therefore, power contactor, heat control, and timing control (non-synchronous or synchronous). These three control elements, in various combinations, will meet the needs of almost any type of resistance welding machine, whether it be designed for spot-welding, pulsation spot-welding, projection welding, butt-welding, seam-welding, or flash-welding.

### *Elements of the Spot-Weld Cycle*

One of the chief differences in these six types of resistance welding operations is in the timing requirements for the weld. In the spot type of weld, for example, the cycle is as shown in Fig. 4. During the first part of the cycle, the electrodes are brought into contact with the work and exert pressure on it, in order to lower the resistance at the weld point as much as possible. This is called the "squeeze" part of the cycle. The length of time between the initiation of the movement of the electrodes toward the work and the beginning of current flow through the electrodes may be synchronized or timed by the aid of a simple mechanical or electronic device.

During the next part of the cycle, called the "weld" time, the ignitron contactors (controlled by either a non-synchronous or a synchronous timer) function to permit the flow of current through the work to form the weld.

At the end of this period, the current is shut off, but the electrodes still maintain pressure on the weld to give opportunity for the molten metal to solidify. This is called the "hold" time.

The electrodes are then withdrawn, and the

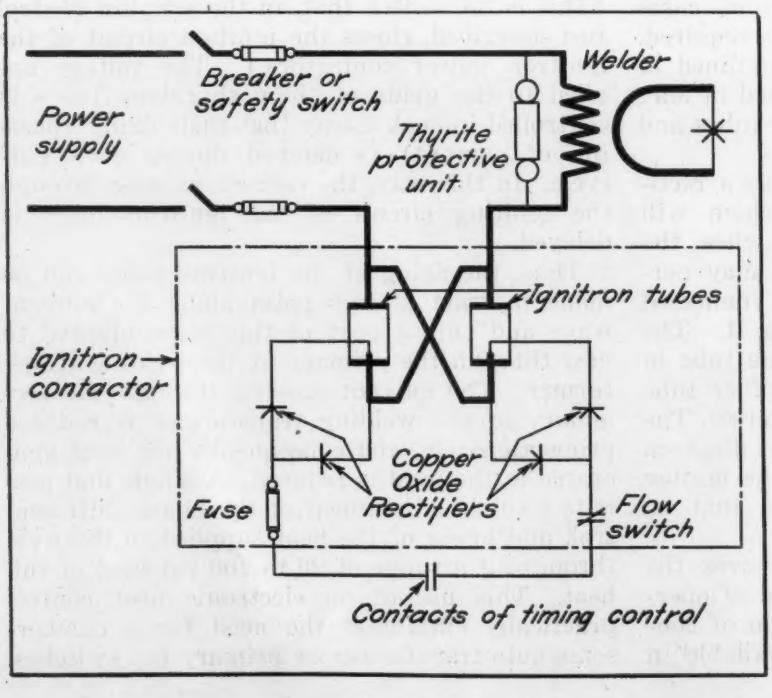



Fig. 1. Schematic Diagram of Simplest Electronic Control for Resistance Welding. Two Ignitron Tubes, Connected in Reverse Parallel, Perform the Function of a Contactor to Open and Close Power Circuit

work is positioned for another weld. If the welding is continuous, progressing rapidly from one spot to the next, this interval between the end of the "hold" time and the beginning of the next "squeeze" time is automatic and becomes part of the weld cycle, being known as the "off" time.

As an indication of how short these parts of each weld cycle are, it may be mentioned that many welding machines function at the rate of one hundred complete weld cycles per minute, and in some cases, as in welding thin-gage materials, they may operate up to 350 weld cycles per minute.

The complete weld cycle can be controlled by either a non-synchronous or a synchronous weld timer, together with a sequence timer. The sequence timer times and controls the various mechanical functions, and the weld timer controls the time of current flow. The sequence timer, weld timer, and contactor may be furnished as separate units or combined into a single unit.

In making a seam weld in which wheel type electrodes are used, such as the welding of droppable airplane gasoline tanks (Fig. 5), the spot-welds may overlap to form a gas-tight seam or they may be spaced to form a series of spot-welds. For these applications, synchronous control is essential to avoid accumulative transient currents, which will cause erratic welding and overheating of the welding transformer. The control for this type of application allows the current to flow intermittently with a certain number of cycles on ("heat" time) and a certain number of cycles off ("cool" time).

With this type of timer, a definite number of weld impulses can also be given to the same spot to form a pulsation weld. Such a cycle is somewhat more complicated than that shown in Fig. 4. Fig. 6 shows a pulsation weld cycle having three weld impulses. The weld timer controls the time of current flow throughout sector *A* in the illustration, while the sequence timer controls the welding machine electrode sequence throughout sector *B*.

One of the most recent types of timers not only times the welding current in impulses, but also times the pressure in impulses. Such an electronic timer is being used successfully for resistance forge welding. The sequences that must be directly controlled by the timer are: Initial (low) welding pressure; low weld current; impact (high) forging pressure; high weld current; "cool" time; "hold" time.

The welding of two pieces of 3/4-inch by 3/4-inch iron bar stock furnishes a typical example. When the operator closes the starting switch, the timer initiates and controls the following welding cycle: (1) Air is admitted to the lower cylinder of the compound booster; (2) the electrodes close on the work under 2000 pounds pressure; (3) the transformer primary circuit is closed for the first stage (low) welding current, which lasts for ten cycles and brings the work surfaces into intimate contact; (4a) hammering begins when the timer admits air intermittently to the upper cylinder for ten blows of 0.166 second each; (4b) the welding current changes from a low to a high value and is applied in exact synchronization with each blow; (5) the weld is completed and cooled under low pressure.

When each heating or cooling time during a

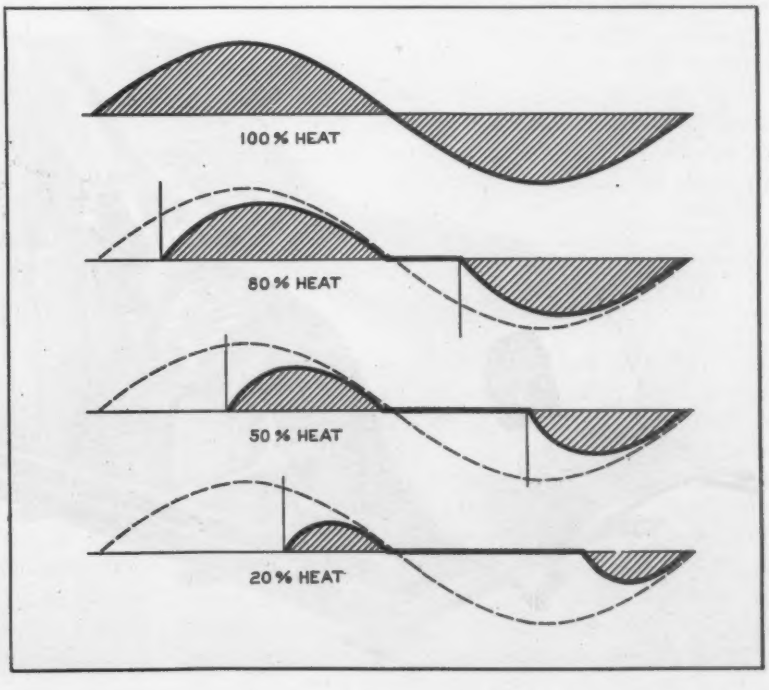



Fig. 2. The Phase Shift Control Delays Ignition of Power Contactor Tube, so that Only Part of Each Alternating-current Wave is Passed to Welding Transformer, thus Controlling Heat Generated at Weld

pulsation weld is less than six cycles (1/10 second) in duration, it may be necessary to use a sequence timer in conjunction with a synchronous control. A sequence timer controls the sequence of weld operations, but has no provision for controlling the length of current flow. This part of the cycle is accurately taken care of by the synchronous timing circuit.

The classes of semi-automatic, automatic, and sequence timers listed by the National Electrical Manufacturers' Association (NEMA) are as follows:

### *Semi-Automatic Weld Timers*

1A *Non-Repeat* without non-beat* feature, providing weld time only; for use on manual-, air-, or motor-operated welders having maintained contact type initiating switch.

1B *Pulsation, Non-Repeat* without non-beat feature, providing weld interval, heat, and cool times; for use on manual-, air-, or motor-operated welders having maintained contact type initiating switch.

### *Automatic Weld Timers*

For use on air-operated welders operated with electric solenoid air valves.

2A *Non-Repeat,* providing weld and "hold" time.

2B *Non-Repeat, Non-Beat,* providing squeeze, weld, and "hold" time.

3A *Repeat, Non-Beat,* providing weld, "hold," and "off" time only.

3B *Repeat, Non-Beat,* providing squeeze, weld, "hold" and "off" time.

4A *Pulsation, Non-Repeat, Non-Beat,* providing weld interval, heat and cool times, and "hold" time.

4B *Pulsation, Non-Repeat, Non-Beat,* providing squeeze time, weld interval, heat and cool times, and "hold" time.

5A *Pulsation, Repeat, Non-Beat,* providing weld interval, heat and cool times, "hold" time, and "off" time.

5B *Pulsation, Repeat, Non-Beat,* providing squeeze time, weld interval, heat and cool times, "hold" time, and "off" time.

### *Sequence Timers*

For use on air-operated welders operated with electric solenoid air valves.

6A *Non-Repeat, Non-Beat,* providing "hold" time only.

6B *Non-Repeat, Non-Beat,* providing squeeze and "hold" time.

7A *Repeat, Non-Beat,* providing "hold" and "off" time.

7B *Repeat, Non-Beat,* providing squeeze, "hold," and "off" time.

8A *Pulsation, Non-Repeat, Non-Beat,* providing weld interval, cool time, and "hold" time.

8B *Pulsation, Non-Repeat, Non-Beat,* providing squeeze time, weld interval, cool time, and "hold" time.

9A *Pulsation, Repeat, Non-Beat,* providing weld interval, cool time, "hold" and "off" time.

9B *Pulsation, Repeat, Non-Beat,* providing squeeze time, weld interval, cool time, "hold" time, and "off" time.

*The non-beat feature provides that, once the welding cycle has been initiated from the pilot switch, the welding cycle will be carried through to completion, regardless of whether the pilot switch remains closed or not.

Fig. 3. When Welds are of Relatively Long Duration, Non-synchronous Electronic Control can be Employed, as in the Multiple Spot-welding of Automobile Bodies

Another factor that must be closely controlled if good welds are to be obtained is voltage variation. In some forms of welding, only a voltage variation of less than 3 to 5 per cent is tolerated. When there are a number of welding machines operating on the same line or when there is other equipment on the line, great difficulty may be experienced in keeping the voltage applied to the welding machine within the allowable limits. This is one of the reasons why a new type of resistance welding equipment was developed. At this point it may be helpful to review briefly the background of the development of this equipment.

### *Resistance Welding before the War*

Before the armament program, 70 per cent of the resistance welding in this country was done in the automotive and accessory industries. There were about 20,000 resistance welders in the service, and all of these were of the alternating-current, single-phase type. Power was taken directly from the line and was used without conversion other than for reduction of voltage. Most of the resistance welding at that time was on steel and steel alloys.

In the early days of resistance welding, heat was applied liberally and a large number of spot-welds of low consistency were used where a few good ones would have been satisfactory. Such undesirable conditions as severe electrode marking, warping, blacking, and scale were frequently experienced, so that the process was applied only to those sheet-steel structures in which such irregularities were not important.

The timing of spot-welds became extremely accurate a little more than ten years ago. Since then, users have gradually accepted the desirability of having accurate timing for more and more applications. With the advent of the defense program, followed by all-out armament for war, precision timing became absolutely essential for spot-welding aluminum, as well as for many other important war applications.

An additional factor that had to be taken into consideration in developing resistance welding equipment for the spot-welding of great quantities of aluminum parts used in aircraft construction was that the power supply of most aircraft factories was inadequate to meet the many burdens placed upon it and carry a heavy resistance welding load as well. This load is particularly heavy because of the weld characteristics of aluminum alloys. Whereas only a few thousand amperes is required to weld thin-gage stainless steel, upward of 50,000 amperes is required for aluminum alloy sheet of comparable thickness. With several of these machines operating on the same supply line, there would be sufficient voltage variations to seriously affect the quality of the welds. This factor, plus the large volume of work, resulted in the redevelopment in this country of two types of resistance welding equipment that had been used for some time in Europe.

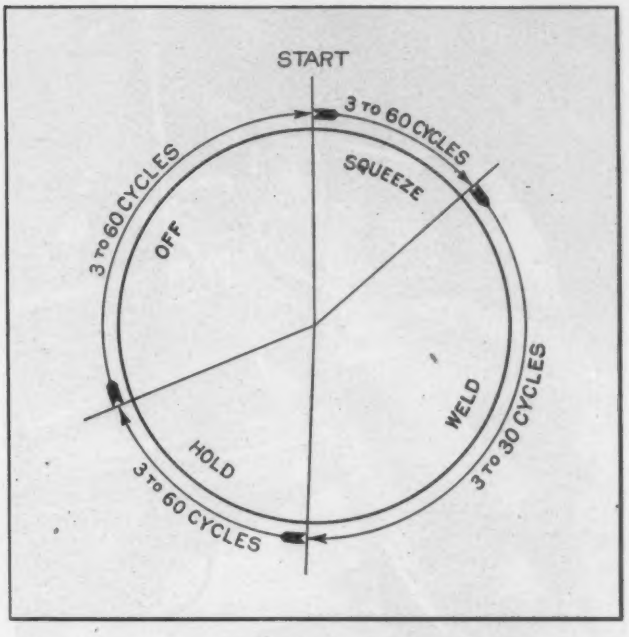



Fig. 4. Timing Cycle for Spot-weld. The Complete Cycle is Divided into Four Periods—Squeeze, Weld, "Hold," and "Off"

These two types of resistance welders operate on direct current obtained by rectifying power from an alternating-current line, and make use of the energy storage principle. Electrical energy is withdrawn from the line at a moderate rate, stored up until enough is available, and then discharged rapidly through the weld. An additional factor tending to reduce the load on each individual power line wire is that the storage type of resistance welder is usually connected to a three-phase power supply, so that current flows through three wires instead of two. In this way, the high current values required in welding aluminum can be supplied without undue demands on the electrical systems of the aircraft plants.

### *Electronic Controls for the Storage Type of Welders*

In one of the storage types of resistance welders, the electrical energy is stored as a magnetic field, and in the other as an electrostatic field. In the magnetic storage type of resistance welding machine, electronic equipment plays an important part. A three-phase rectifier using ignitrons, which are fired through phanatrons (mercury-vapor two-element tubes) or thyratrons, is employed to supply direct current for storage in the transformer primary. A thyratron phase control may also be used to regulate

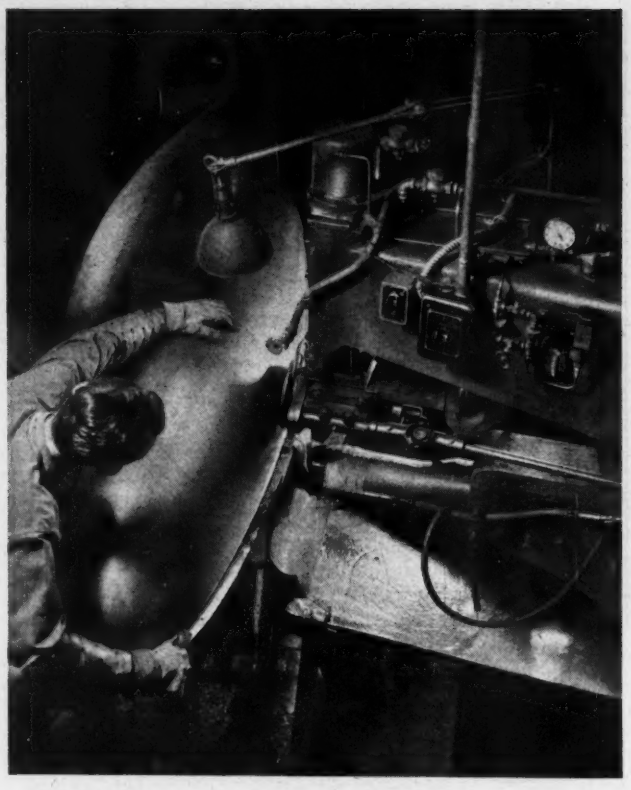
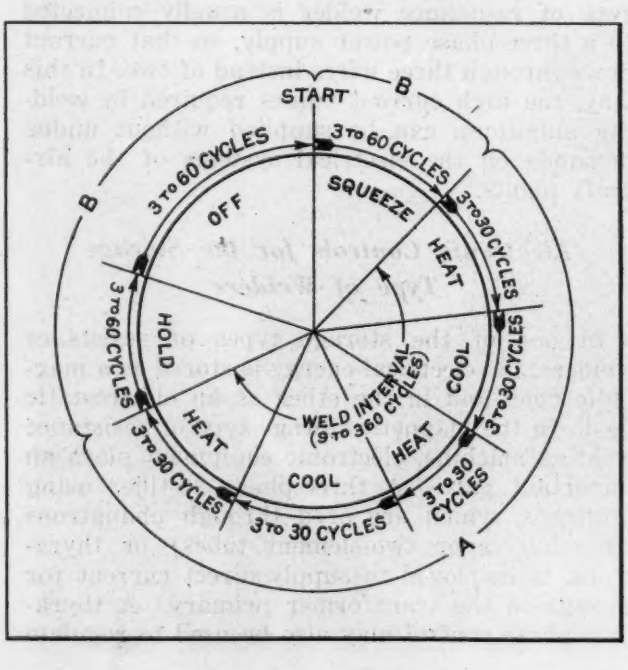


Fig. 5. Seam-welding of Droppable Gasoline Tanks with Electronic Control which Assures Tough, Vibration-proof, and Gas-tight Seams. With This Control, Welding Progresses at the Rate of 60 Inches per Minute

Fig. 6. Timing Cycle for Pulsation Weld. During This Single Cycle, Three Impulses of Current are Sent through the Weld with "Cool" Periods between. Accurate Timing of Each Cycle Period is Secured by Electronic Control




the direct-current voltage applied by the rectifier to the transformer primary.

Because the primary circuit of this transformer is highly inductive, current through it builds up very slowly. During this initial build-up period, the electrodes are held against the work, so that the secondary circuit is closed. At first no current flows in the secondary circuit, but as current in the primary circuit builds up, a small current is induced in the secondary circuit, which serves to preheat the weld. When the current in the primary has reached a sufficiently high value, the primary circuit is suddenly broken. The energy stored in the transformer primary is now released, but has nowhere to go, except into the transformer secondary. A heavy current is thus caused to flow through the electrodes to form the weld.

In the capacitor storage type of resistance welding machine, direct current at high voltage is supplied to a bank of capacitors which are connected across the primary of the welding transformer. When the capacitors have been charged to the desired voltage, the rectifier supply circuit is opened. The electrodes are then brought into contact with the work and ignitron tubes connecting the capacitors with the primary of the welding transformer are fired. A high voltage is thus suddenly placed across the transformer primary, and a heavy current is induced in the secondary which flows through the electrodes to form the weld.

Electronic equipment, again, plays a vital part in the functioning of this type of resistance welding equipment. Thyratron tubes are used to rectify the alternating current for the capacitor discharge control, because the current is low and within the rating of the thyratron, while the voltage is high and above the ratings of available ignitrons. These thyratrons, in turn, are phase-controlled by other thyratrons which govern the amount of direct current flow delivered by the rectifiers to the capacitors, determining the length of time required to charge them to the desired voltage.

### *Electronic Controls with Special Functions*

In addition to the electronic controls already described, there are a few having specialized functions which should also be mentioned. For certain types of welds, the amount of heat required may vary during the weld period. Thus, an initial high heat may be needed to form the weld, followed by a low heat to anneal it. Or it may be that a series of welds is to be made in repeated sequence with different heats required for each. A phase shift heat control, provided with several dials that can be preset, automatically provides this change in heat from one part of the weld period to the next or from one weld to another. An auxiliary control has

been developed which is particularly suitable for use in the spot-welding of air-hardenable steels, since it permits tempering the weld while the work is still in the machine, thus reducing hardness and increasing ductility.

It may be that the material being welded has magnetic properties, so that the amount of metal inserted in the welder throat affects the operation of the transformer secondary. Thus, if the amount of magnetic material inserted in the welding throat area increases appreciably, a larger secondary voltage is required to produce sufficient current for a satisfactory weld.

Electronic tube current-regulating compensators are available which automatically correct the effect of changes in the transformer secondary inductance caused by insertion of magnetic material in the welder throat, and thus constant current through the weld is maintained. Such a compensator will hold the welding current to a variation of $\pm$ 2 per cent under the same conditions that would cause the unregulated welding current to vary $\pm$ 20 per cent.

Another useful electronic device is the weld recorder, which prints a record to show the amount of current squared multiplied by time ($I^2T$) at each weld. It gives an audible signal and locks out the welding machine if this value is not within pre-established limits. Weld heat is proportional to current squared multiplied by time multiplied by resistance ($I^2TR$), so that the recorder will function to detect poor welds if the resistance of the successive welds remains relatively constant.

When sheets of uniform thickness and analysis are being welded, with electrode pressure constant, the electrode tips properly maintained, and contact surfaces at the weld uniformly clean, the resistance of each weld will not vary appreciably, and this recorder will provide a valuable control of weld quality. Weld recorders are used in such operations as the fabrication of stainless-steel railroad cars, shown in Fig. 7.

Not a resistance welding control, but nevertheless an electronic device that has appreciably aided the spot-welding of aluminum parts for bombers is the electron defraction camera. This camera consists of a high-voltage source, an electron gun, and an electron defraction vacuum camera. The gun is used to fire a stream of electrons against the metal surface to be analyzed, while the defraction camera photographs the angle at which the electrons are deflected. Different chemicals produce different angles, and thus the chemical structure of the surface under examination can be determined.

Using this equipment, the Ford Motor Co. found out why aluminum sheets meeting identical Army specifications, which were similar in appearance but originated in different plants, produced welds of varying quality. The cause was traced to surface oxides. Nine different oxides were isolated, the conditions under which the aluminum was fabricated determining the type of oxide found on its surface.

It was also discovered that while various cleaning chemicals removed anti-welding oxides, they often deposited other oxides equally undesirable. As a result of these tests, considerable improvement in spot-welding technique has been made.

The manufacturers of electronic controls for resistance welding equipment who have cooperated in supplying material for this article are: Electronic Products Co.; General Electric Co.; Sciaky Bros.; Taylor-Winfield Corporation; Weltronic Co.; Westinghouse Electric & Mfg. Co.

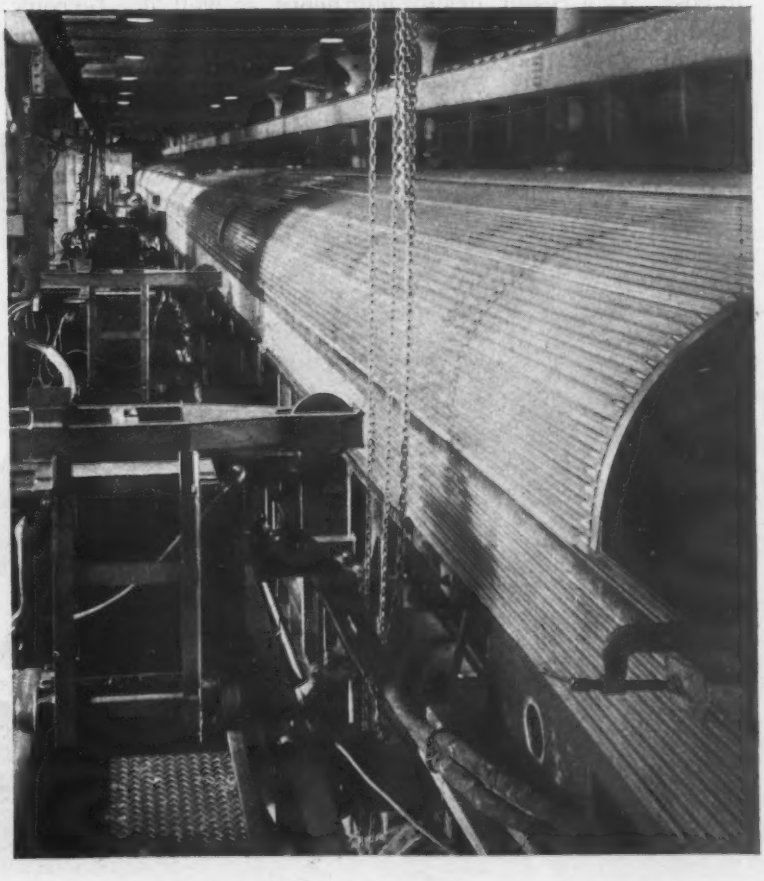


Fig. 7. Weld Recorders Aid in Maintaining the Uniformity of the Spot-welds Used to Fabricate This Stainless-steel Railroad Car. Electronic Controls are an Important Factor in the Successful Application of Resistance Welding in This Field

# Experience in War Production Points to

By R. L. WILCOX, Consultant
Conservation Division, War Production Board

THE war emergency has given added impetus to the die-casting method of fabrication. It has achieved for this process what even the most conservative promotional or educational program could not have accomplished. Before the war, manufacturers were chiefly concerned with producing a salable product at a profit. Sometimes this product was made better than required for its purpose, and sometimes methods were employed that were unnecessarily wasteful of man- and machine-hours. The availability of labor was not the problem that it now is, since, relatively, labor was more obtainable than materials; hence, the methods used were frequently wasteful of man-power.

The present emergency has taught American manufacturers many things—among others, that supplies of raw materials are not inexhaustible and that conserving labor in manufacturing is an important item. As regards materials, it has been found that many alternative materials will produce a product that not only gives equally satisfactory results from a performance point of view, but also may introduce significant savings in cost. As a result, design engineers, as well as production executives, have focussed their attention upon the die-casting method of fabrication as a means of achieving volume production with a minimum expenditure of materials and man-hours.

The many advantages of the die-casting method were just beginning to be fully appreciated before we entered the war. In 1941, for example, the die-casting industry consumed 180,000 tons of zinc, aluminum, magnesium, copper, tin, and lead—about 75 per cent of the total amount being zinc. While the combined consumption of these metals is considerably less during the present war production program, much experience has been gained as regards both method of fabrication and alloys used.

The need for special-quality castings for war applications spurred the die-casting industry to strive for improvement in its product. Many die-casters added X-ray, spectrographic, and other physical testing equipment to augment their facilities for producing controlled-quality castings. The improvements thus obtained have already enabled die-castings to enter new fields and to be used for applications heretofore not believed feasible—applications for which nonferrous forgings costing more and requiring more machine work had formerly been specified.

Because of the greater demand for special die-

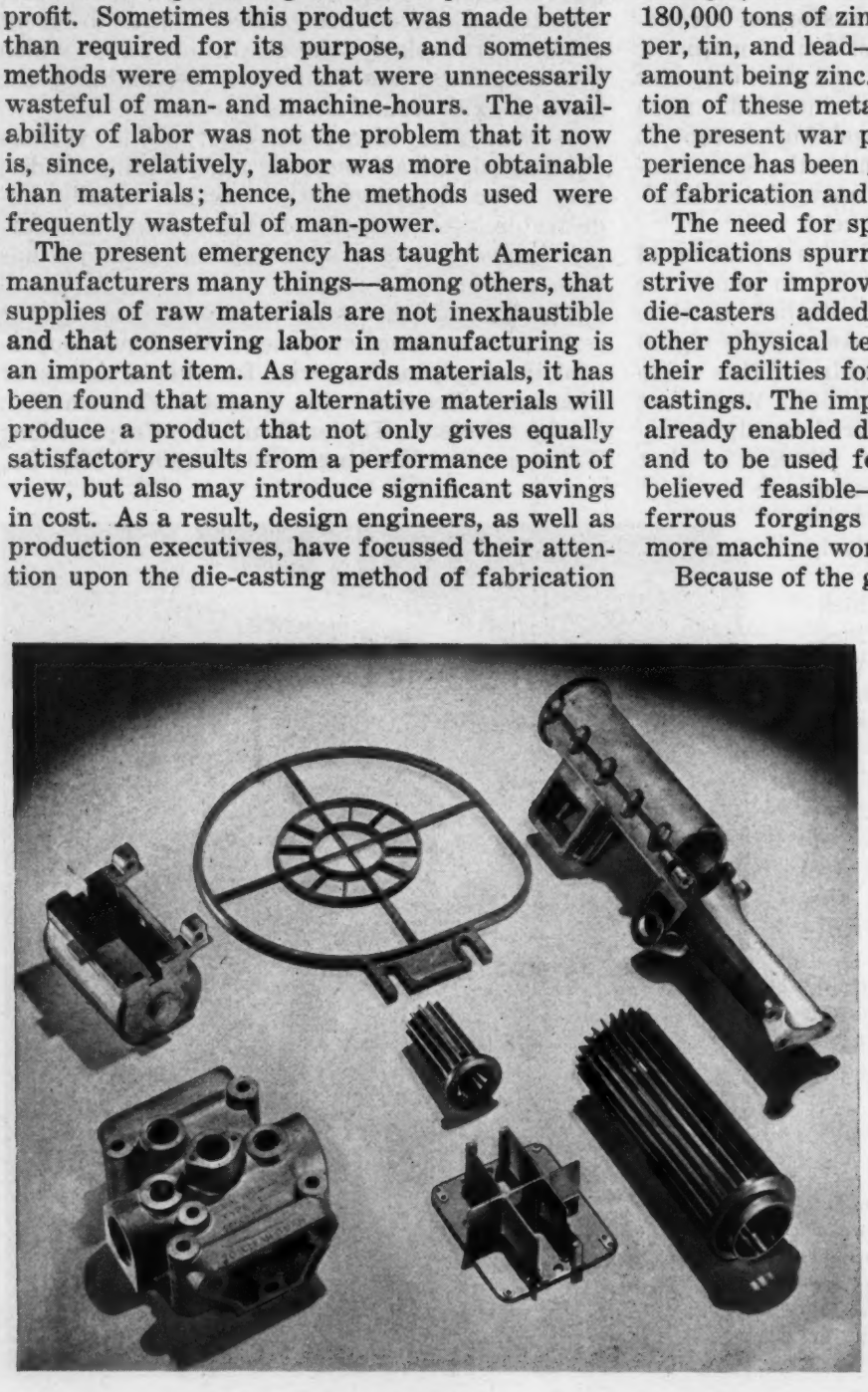


*Fig. 1. Typical Zinc-alloy Die-cast Parts for Aircraft Artillery and Armored Vehicles*

# the Future of Die-Castings in Peacetime

castings, more and better facilities for their production are available today. Many old die-casting machines have been scrapped or rebuilt, and a large number of machines of the latest types have been installed. Between June 30, 1941, and the present time, the total number of all types of die-casting machines in this country has been increased by about one-third.

Experience has been gained from the exchange of ideas and information with our Allies, particularly the British. Because of their extremely critical labor supply, they have utilized die-castings for military purposes far beyond what was thought possible by our own manufacturers. This experience has been an important factor in expanding the field of die-casting in this country. A few typical zinc die-castings made in Great Britain for aircraft artillery and armored vehicles are shown in Fig. 1.

Experience gained in casting aluminum and magnesium alloys in cold-chamber machines, resulting from the demand for light-weight alloys in aircraft, has already contributed much to our knowledge of handling these alloys. This will undoubtedly lead to their wider use, particularly in view of the greater availability of these alloys, as compared to pre-war days. A few typical aluminum and magnesium alloy die-castings for aircraft are shown in Fig. 2.

From a performance standpoint, there is no question but that die-castings made from zinc, aluminum, magnesium, copper, tin, and lead alloys have proved to be good engineering materials, capable of doing a job when given the opportunity by proper selection and sound engineering design. An analysis of actual case histories of several munition components, where the method of fabrication was changed to die-casting, showed that (1) deliveries were improved from two to six times; (2) costs were reduced from 25 to 75 per cent; and (3) the labor required was reduced from 20 to 80 per cent.

Because of the lessons learned in the efficient use of materials, machines, and labor during the present war production program, the die-casting method of fabrication will undoubtedly be used to a greater extent than ever in the manufacture of the tremendous volume of consumer goods that will be required to satisfy pent-up demands in the post-war civilian economy.

* * *

## Grover Cleveland on Federal Aid

The lesson should be constantly enforced that though the people support the Government, the Government should not support the people.... Federal aid encourages the expectation of paternal care on the part of the Government and weakens the sturdiness of our national character.—*Grover Cleveland in 1887*

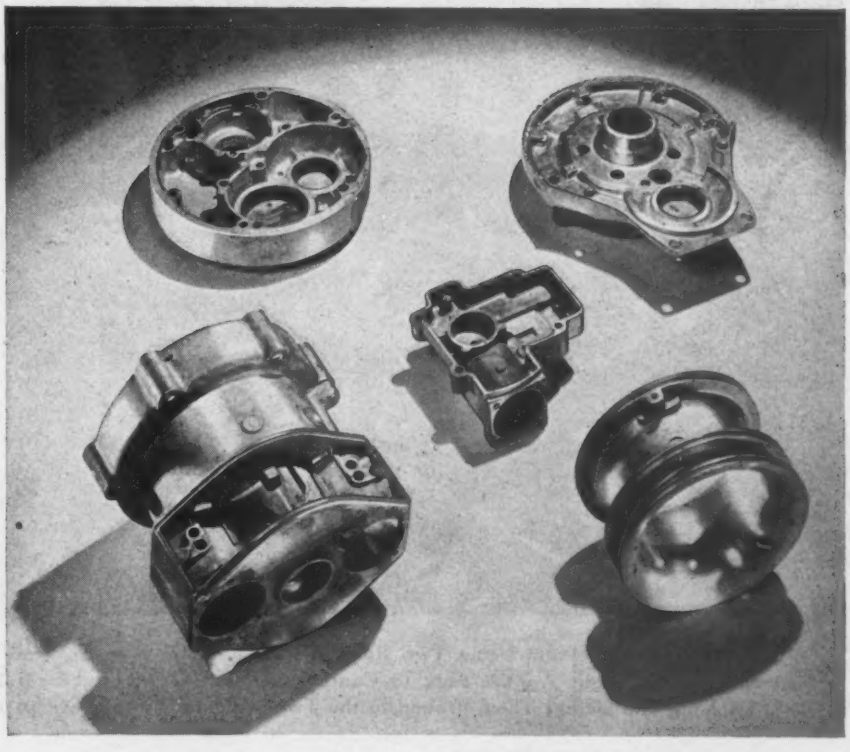


*Fig. 2. Examples of Aluminum- and Magnesium-alloy Die-cast Parts Used in Aircraft*

# Unique Jig Devised for Canteen Welding

By W. F. LAUTNER
Applied Engineering Supervisor
Air Reduction Sales Co.
Wheeling, W. Va.

OXY-ACETYLENE welded aluminum canteens for the armed services are being turned out in large numbers on a novel production line at the U. S. Stamping Co.'s plant at Moundsville, W. Va. Ten identical jigs, of a unique design devised by the company, are operated by fifteen girls, the full time of one girl being required to apply flux to enough canteens to keep two girls busy with the actual welding.

Production begins with the punching of top and bottom sections for the canteens from sheet aluminum. These stampings are cold-drawn to the proper shape and trimmed to exact dimensions, leaving a circumferential flange for the welding of an edge joint. The two halves shown at the left in Fig. 1 are then forwarded to the welding department, where they are assembled into a complete canteen (as shown at the right) by welding.

Fig. 1. Top and Bottom Sections of Canteen, as Shown at Left, are Flanged for Edge Joint. The Canteen at Right is Fluxed Ready for Welding

Three girls work as a team, using two welding jigs, as shown in Fig. 2. This set-up makes possible continuous operation of the welding torches, eliminating idle time or interruptions for jigging, fluxing, or removal of finished canteens. There are five teams, one of the three girls in each team applying the flux, as shown to the right, Fig. 2, while the other two girls do the welding. Each welder has her own jig, which swings between her and the girl who applies the flux. The jig consists of a flat skeleton panel, pivoted on a supporting base and rotated horizontally by hand like a turnstile. It is fitted at each end with a fixture and chuck which hold the two halves of the canteen in alignment, positioned 60 degrees from the horizontal for convenient welding.

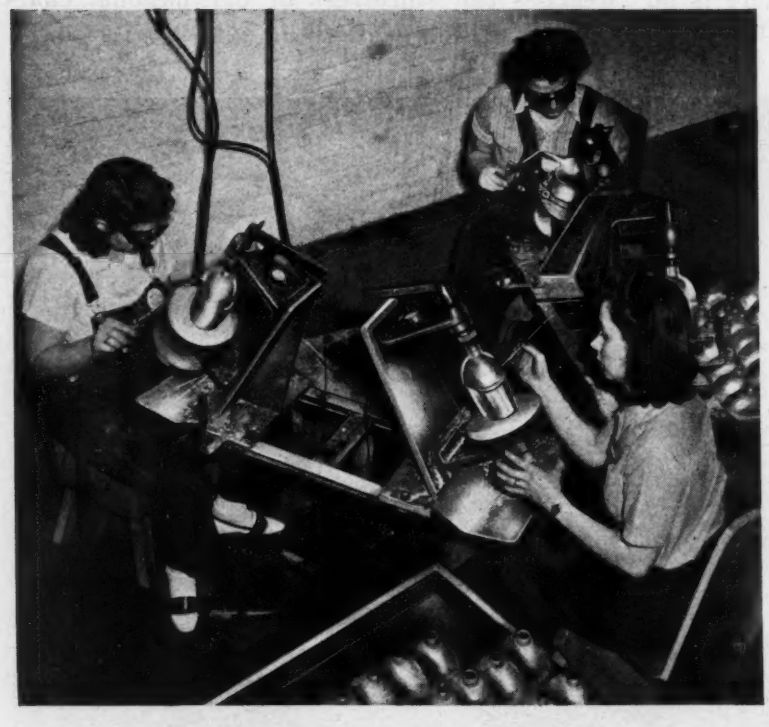


Fig. 2. Three-girl Team Using Two Jigs for Welding Canteen. Girl at Right Applies Flux to Canteen Sections on Each Jig and Swings Them around to the Two Welders

The girl who applies the flux chucks the two halves of a canteen on one end of a jig, applies liquid flux to the seam with a brush, swings the work around to the welder at the other end, and replaces with new sections the finished canteen which swings around to her. The process is repeated on the other jig for the second welder, each jig being within easy reach of the girl applying the flux.

The fixture that grips the halves of the canteen can be rotated by means of a handwheel, which the operator turns with her left hand while welding, as shown in Fig. 3. The flanged-edge joint makes possible a quick, easy weld without using filler rod. The average weld is completed in one minute twelve seconds, and there is almost no danger of burning through.

Special oxygen and acetylene pipe-line extensions were installed,

so that each welder has her own regulator station outlets. The gases are supplied by a stationary oxygen cylinder manifold and two Airco 500-pound double-rated acetylene generators, all housed in a small concrete building near the plant. The welding torches used for this light aluminum work are Style 9100, fitted with Style 893 No. 1 tips.

Approximately 0.09 cubic foot of oxygen and of acetylene, each, is consumed in the welding of one canteen, according to figures based on the consumption of calcium carbide and of cylinder oxygen in the production of 30,000 canteens.

* * *

## Westinghouse Sponsors Electronics Training Course

A course designed to give a clear conception of the basic principles and applications of electronics in industry has been prepared by the Westinghouse Electric & Mfg. Co. This course includes sound slide films, lesson books, and an instructor's manual on the subject of electronics. The course was originally designed for Westinghouse employes, but the material has now been made available to others at cost, because of many requests from engineering groups and individuals interested in this subject. Further information can be obtained directly from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Fig. 3. The Welder Rotates the Canteen by Turning the Handwheel below while Making the Edge Joint Weld without the Use of a Filler Rod

## Carbide Tools in Stamping and Press Operations

The commercial application of carbide tools for press operations was interrupted by the outbreak of the war; but peculiarly enough, although the war interrupted this development commercially, the lessons learned in producing armament parts with carbide press tools has greatly advanced the art. An outstanding illustration is that of forming cartridges and shell cases. Carbide dies have been an important item in making possible a change from brass to steel cases.

The prime reason for the growing interest in the use of carbides for press work is due to the high abrasion resistance of carbides, which means that carbide dies and tools will maintain close limits and a high finish over long runs. It is true that carbide dies cannot be used everywhere, and cannot always be used interchangeably with steel dies. Where applicable, however, they will greatly prolong die life in forming both ferrous and non-ferrous metals.

A few examples will be cited of the application of carbide dies. In making eight draws on automotive engine cylinder sleeves, carbide dies have had a life of 200,000 pieces before being reconditioned. Dies used to burnish the flats and to hold sharp corners of nuts which have been punched and sheared, when made from carbides, have produced upward of one hundred times the number of parts that could be produced when steel dies were employed. In manufacturing a ferrule from nickel alloy steel, carbide dies have produced 3,000,000 parts and are not yet worn out. These are but a few examples of the long life that may be expected from carbide dies when applied to work for which they are suitable.

* * *

## Gage for Checking Size and Shape of Countersinks

The Dayton Rogers Mfg. Co., 2835 Twelfth Ave. S., Minneapolis 7, Minn., is distributing a countersink gage for checking machined countersinks as to size and shape. Five different countersink angles are included. These gages can be used both for grinding the tools and for checking the finished work. They will be sent by the Dayton Rogers Mfg. Co. to anyone making a request on his company's letterhead.

# Government, Management, and Labor

**Industrial Activity, Reasonably Full Employment, and National Economic Well-Being can be Assured if Government, Business Executives, and Labor Leaders will Seriously and Honestly Cooperate to Achieve that Purpose**

THE war has demonstrated the value of cooperative effort, and should have convinced us that there is nothing that sensible men determine to do that cannot be done, provided those who are involved in the doing work together as a team and put forth their best efforts.

Of course, the direct responsibilities of each group and of each individual cannot be completely fulfilled unless there is collaboration and coordinated effort between the groups and between the individuals within the groups. One alternative to voluntary cooperation is forced cooperation resulting from governmental, managerial, or economic pressure. It cannot be as effective as voluntary cooperation. The American people do not want that kind of cooperation.

In the following paragraphs, some of the responsibilities of our Government, the managers and owners of American industries, and labor leaders and unions have been outlined. Unless each of these groups does its share, complete success cannot be achieved. If each will honestly and earnestly do its share, industrial production, reasonably full employment at high wages, and goods produced at a cost that will insure sustained marketability are possible. What we need is less individual selfishness and more cooperative effort to serve the interests of all; because in the long run, whatever promotes production, employment, and reduced costs will benefit everybody who contributes in a constructive manner to the nation's well-being.

### *The Responsibilities of the Government*

National economic welfare cannot be achieved, nor can private enterprise be maintained, without the help and cooperation of Government. Its responsibility is to adopt policies and laws that will aid industry to function as effectively as possible in promoting the welfare of the American people. To this end, Government should do the following things:

1. Encourage individual enterprise and effort and group cooperation.
2. Protect equally the rights and the interests of management, agriculture, labor, and all other groups.
3. Prevent lawlessness and gangsterism.
4. Protect the authority of management that is essential to efficient operation.
5. Make possible an orderly adjustment of wartime distortions in the wage structure.
6. Administer government as economically as possible.
7. Keep taxes as low as possible, and so change our methods of taxation as to encourage efficiency of business operation, investment, new enterprise, and risk-taking.
8. Accomplish an orderly industrial reconversion by adopting fair and helpful policies of contract termination and disposal of surplus plants and commodities in collaboration with business, labor, and other elements of private enterprise.
9. Participate in every practical cooperative effort to remove unnecessary and detrimental barriers to international trade, but protect by reasonable import duties the jobs of American workers in industries, the existence of which is nationally important and which are at a serious disadvantage because of low wages in competing countries.
10. Continue reasonable immigration restrictions.

### *The Responsibilities of Managers and Owners of Businesses*

Managers and owners of business have a public duty, as well as a selfish interest, in trying to create conditions of general prosperity, as a result of which more jobs will be created and profits will be realized. It pays industry to expand employment, production, and sales.

Material progress is the result mainly of improvement in the technique of labor saving. But, unless the labor thus saved can be utilized in additional production, we are not better off but worse off. Therefore, improved efficiency should result in lower prices, which will produce an increased demand in the case of many products and make possible higher rates of pay. The automobile industry has furnished outstanding evidence of this fact.

Price reduction is the most effective means for accomplishing a general distribution of the gains from technological progress and for increasing demand for products and job opportunity; and mass production, into which we shall be increasingly driven, will force a wider adoption of low-price policy.

Most business concerns are continually trying

# Responsible for Post-War Employment

By ROBERT D. MAGILL
Stevenson, Jordan & Harrison, Inc.
Management Engineers
New York City

to lower prices as a means of increasing demand and securing more customers. They want their workers to help them get costs as low as possible through increasing output; but many of them do not seriously or intelligently attempt to create the conditions that would stimulate employes to assist in this effort, such as stabilized employment, good working conditions, good labor relations, adequate training, advancement opportunity, personal recognition, incentives, and real participation of employes in determining the conditions under which they function, such as shop conditions, working rules and practices, production and wage standards, job evaluation. This does not mean that the essential prerogatives of management should be surrendered or that the direction of the business should be in the hands of a debating committee.

Management has the major responsibility for establishing good labor relations and for stimulating worker efficiency—a fact that some managers do not understand.

Only through unit cost reduction, with most of the cost saving reflected in lower prices, can we hope to expand our foreign markets or even to maintain permanently our pre-war volume of exports. Otherwise, increased mechanization and much lower wage scales than ours in competing countries will shut some of our products out of foreign markets.

Management should want to keep wages as high as possible without forcing prices to an uneconomic level, but there will have to be real cooperation from workers if the wage rates that will exist at the end of the war—probably 5 to 10 per cent higher than at present—are not to be lowered.

### *The Responsibilities of Labor Leaders and Unions*

The major objective of workers is the same as that of management—to obtain the greatest possible personal and material satisfaction from their efforts. The workers in our industries want steady jobs, high wages, and low prices. They can have these things only by helping management to obtain the maximum output of goods of satisfactory quality from each labor hour.

Only as the enterprise of which they are a part prospers, improves its productive and distributive methods, and is able to reduce its prices, can the employes fully achieve their desires. Most employes do not realize this important fact. It is a responsibility of management to help them to understand it.

Raising hourly wages without a compensating increase in hourly output usually will make higher prices inevitable. Such a wage rise in one industry may benefit temporarily the employes in that industry, but it will be at the expense of the workers in other industries, and ultimately whatever benefit there was to the workers who got the raise will be lost.

### *Merely Raising Wages Solves No Problem*

Neither more jobs nor more purchasing power will be created merely by raising wages. Workers can "price" themselves out of a job, as manufacturers and merchants can "price" themselves out of a market. The way to sell more labor at a higher price is not to charge more for what it produces but to charge less per unit of output and to produce more units. "If workers are to have more of the good things of life, those things must be produced, and produced more abundantly," as Eric Johnston has remarked.

Some of the leaders of organized labor understand these facts, especially the national leaders; nevertheless, it has been the practice of most unions to seek successive increases in wages and every conceivable advantage whenever a contract expires, without regard to the ultimate bad consequences to themselves and to their employer if their demands are granted.

Many unions have also restrained production by "slowing-down" and "feather-bed" rules and by refusing to work under incentive systems. In innumerable cases, we have seen output per hour increase 20 to 50 per cent after a wage incentive system has begun to operate and production restraints have been thrown off.

Workers and their representatives will have to remove all restraints on production and cooperate with management in reducing unit labor cost if the present peak level of wage rates is to be maintained or increased.

It should be understood that any wage increase which raises unit costs of production creates a need for the use of labor-saving machinery. This, in itself, is not objectionable. On the contrary, the more labor-saving machinery that is used,

the higher wages can rise and the cheaper will be the goods produced.

A general rise of wages at the expense of profits would reduce employment and diminish the workers' total incomes, because it would discourage investment, operating improvements, expansion, and new enterprise. Normally, the profit margin of industry as a whole has been little more than the prevailing rate of interest. In many industries, the earning of any profit may depend entirely upon highly efficient management.

The unions have a heavy responsibility for the maintenance of cost-price relationships that will enable business to furnish the number of jobs that are going to be in demand after the war and to pay good wages. Will they help or hinder in achieving these objectives? We have faith that they will do their part if management and Government will each fulfill its responsibilities.

With a fully united America, with peace assured at home, as well as in the rest of the world, we could show the world something in national economic progress that would exceed anything accomplished in the past.

* * *

## Wartime Steels Will Find Peacetime Uses

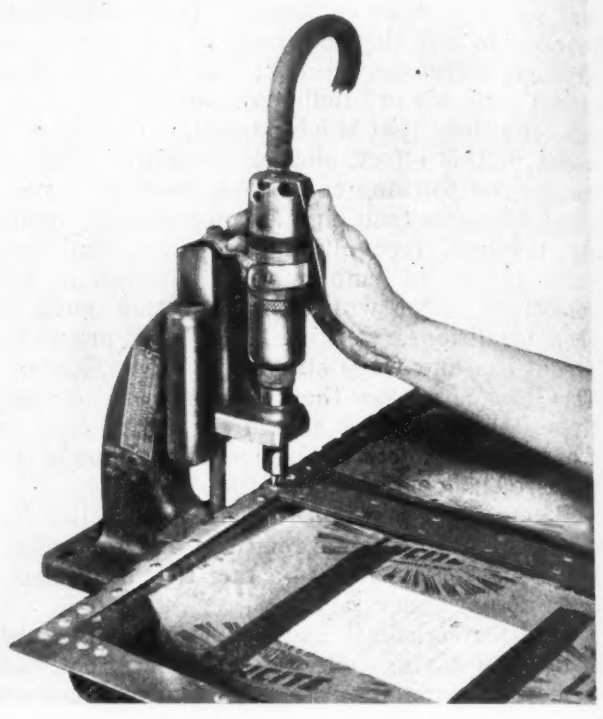
In a paper read before the recently held Tractor Meeting of the Society of Automotive Engineers in Milwaukee, H. B. Knowlton, of the International Harvester Co., Chicago, Ill., emphasized the importance of the peacetime use of the National Emergency steels. The use of these steels enabled the United States to outproduce the entire world. These steels have proved wholly satisfactory and have conserved great amounts of alloying metals, such as nickel, chromium, and molybdenum. The war has demonstrated that low-alloy steels will give satisfactory service for a great many purposes. In the future, it is likely that steel will be selected by various physical properties rather than by chemical composition.

* * *

Americans throughout their history have harbored a healthy distrust of "big government." That distrust remains our greatest defense against "super-statism." I address myself especially to liberals and progressives in urging that this wholesome fear of too much government be kept alive. There was never a time in our career as a nation when it was more important to weigh every project for state control in the scales of personal liberty and personal initiative.—*Eric A. Johnston, President, Chamber of Commerce of the United States*

## Pneumatic Screwdriver for Assembly Work

The adaptation of a pneumatic motor to screwdriving operations at the Columbus, Ohio, plant of the Curtiss-Wright Corporation was accomplished in the effective manner shown in the accompanying illustration. The air motor is attached to a Niagara No. 50 mount, and is



Using a Pneumatic Screwdriver on Aircraft Assembly Work

equipped with a foot-pedal for raising and lowering the screwdriver. When used for setting nuts, a straight socket is provided below the work. The bits used can be modified to accommodate hexagonal bolts and nuts or Phillips screws and bolts.

* * *

## Measuring Surface Finish

Developments in the methods of measuring surface finish by means of the Profilometer will be dealt with in a publication known as "Profilometer Comments" to be published bi-monthly by the Physicists Research Co., Department 2, Ann Arbor, Mich. Profilometer users and others interested in receiving copies should write directly to the Physicists Research Co. The contents of the publication include articles on the operation of the Profilometer for measuring surface roughness, descriptions of Profilometer accessories, and suggestions for its use.

# Economical Application of Industrial Diamonds

THIS article gives a brief review of the types of industrial diamonds used, together with suggestions for their economical application, based on information obtained from Sheldon Booth, president of the Diamond Tool Co., Chicago, Ill.

Industrial diamonds are available in three grades—common, medium, and select. The medium and select stones, being scarcer than the common quality, are about two to four times more expensive. Briefly, the common quality is a big rough diamond of no special shape and with no special density guaranteed. In the medium quality are classified diamonds that have either special shapes for certain purposes or special grain density, but in the latter case without a special shape. The select quality consists of stones that have both special density and special shapes.

Many buyers of diamonds for industrial use specify medium and select quality stones, because they believe that those grades have a much longer life, and that by buying the best grades they are getting more value for their money. This is not always so. In most instances, it is better economy to use the common quality of diamonds which, if bought in the right sizes for the grinding wheels to be dressed, will do as good a job and last as long as the other grades, or longer, provided they are carefully used and reset at frequent intervals. This matter of frequent resetting is highly important, as it will do more than anything else to prolong the life of the diamond. Hence tools that permit the diamond to be reset are recommended.

Many buyers who insist on extreme sharp points in diamonds have made heavy inroads on the higher grades. In actual use, these sharp points eventually become rounded, unless very careful dressing procedure is adhered to. It is believed that the same advantages can be obtained with the common quality stones by applying the diamond to the wheel at a 12-degree downward angle and rotating the nib at intervals. In this way, the diamond sharpens itself while being used, and its cutting efficiency is maintained, while the wear on the diamond is reduced. The life of the diamond is further prolonged by resetting at intervals—usually every two or three months.

It is important to note that the setting of the diamond is a delicate operation. There is a certain grain structure in the diamond that must be observed. It takes long experience and specialized skill to set and reset diamonds correctly. A diamond that does not cut properly when received by the user is not necessarily defective, but should be returned for resetting.

The Diamond Tool Co. uses a method for setting diamonds that tends to prolong their life. There is no extreme hydraulic pressure exerted in the setting process. A hand die-casting process is used, which exerts a pressure of only 15 to 20 pounds on the metal to hold the diamond in the setting during the cooling process. This method, while providing a firm setting for the diamond, avoids any tendency for the diamond to fracture as the result of excessive pressure.

In this process, a silver alloy with a melting point of 1400 degrees F. is used as the holding metal in which the diamond is inserted. By using a metal of such comparatively low melting temperature, the resetting procedure is greatly simplified. In case of an accident, there is also an added safety factor. If a crushing impact should unintentionally be exerted on the diamond by a slip of the operator in feeding, the low melting-point setting alloy will give, thus saving the diamond from destruction and involving only the small resetting cost. Such mistakes by grinder operators will occur in the rush of the war effort, and this type of mounting has saved many diamonds.

Some companies doing precision grinding attempt to cut costs by using the hardest obtainable grinding wheels. The hard wheels may last longer; but what the user fails to realize is that, in most instances, his diamond cost may amount to double that necessary, because of his use of extremely hard wheels.

* * *

## Lincoln Foundation Papers Placed in Ohio State University Welding Library

All papers submitted in the James F. Lincoln Arc Welding Foundation's $200,000 award program of 1937-1938, and the engineering undergraduate award and scholarship program of 1942-1943, have been placed in the A. F. Davis Welding Library of the Ohio State University. The papers add substantially to the mass of welding information in this collection, one of the largest of its kind in the world.

This library, founded by A. F. Davis, vice-president of the Lincoln Electric Co., contains approximately a thousand books on designing for welded construction, welding procedures, and properties of weld metals, as well as welding handbooks, magazine articles, technical papers, and other literature pertaining to the subject of welding. Copies of about 7000 patents concerning welding equipment and applications of welding are included.

# Machining Group-Forged Trip Levers

By FRANK HARTLEY

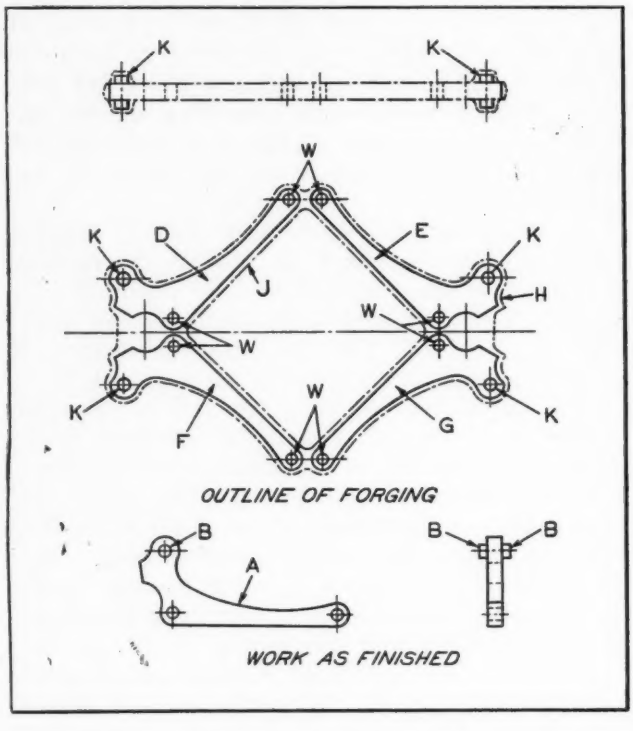



Fig. 1. Group Forging of Four Trip Pawl Levers and a Finished Lever

AN interesting example of the group milling of four parts from one forging is shown in the accompanying illustrations. Proper location of the work in the various work-holding fixtures is assured by performing a preliminary drilling operation on the forging, using the fixture shown in Fig. 3, in which spring bushings are employed to locate the work from bosses on the forging. The operating sequence for machining the work is shown in Fig. 2. Fig. 1 shows the forging outline, together with the finished trip pawl lever *A*, four of which are cut from each forging.

Referring to Fig. 1, the finished work at *A* has a small boss *B* on each side of it. These bosses are known as pivot bosses. Four of these parts are arranged as shown at *D*, *E*, *F*, and *G* in the upper view. The machining of these parts can be more readily handled by making a forging having an outside outline as indicated at *H*, and an inside outline as indicated at *J*. No machining is done on the flat sides of the forging, although the bosses indicated at *K* are hollow-milled.

The first operation performed on this forging, as shown in the upper left-hand corner of Fig. 2, consists of drilling and reaming two construction holes at *A*, using the jig shown in Fig. 3, the work being indicated by dot-and-dash lines at *X*. This jig has a heavy flat-top base section at *A*, on which one side of the work rests. In addition to drilling holes *A*, Fig. 2, two boss clearance holes are drilled in this jig at *B* and *C*, Fig. 3.

In addition, two spring bushings are used at *D* and *E* for the purpose of locating the work from the two rough bosses with which they are in contact. The upper ends of these bushings are bell-mouthed, and the springs at *F* tend to force the bushings against the rough bosses, so that accurate location is obtained from the two bosses as the work is clamped down. Dog-pointed screws at *G* enter elongated slots to limit the movement of the bushings, so they will not spring out of place while the work is being positioned. The work is put into place from the right-hand side of the jig with a sliding and rocking movement. It is placed over the stud *H* with the clamp *J* removed and the work located as far to the right as the large hole in the center of the forging will permit. The work is lifted so the bosses will clear the top of the block *A* as it is being moved into place, there being sufficient clearance at *K* to permit this method of handling.

Two guide bushings at *L*, carried in blocks *M* and *N*, are provided for the spot-drilling, drilling, and reaming operations. Clamp *J* is slotted on one side, so that it can be readily removed without taking off the combined nut and washer *P*.

Because of the protruding bosses, no attempt has been made to set up several of these units in line for milling, each forging being handled as an individual unit. Referring again to Fig. 2, the upper right-hand view shows how both ends of the forging are milled, using a gang of two cutters *B* and *C* with a spacer *D* between them, a section of the work being shown at *E*.

Fig. 4 shows diagrammatically how the work is held for this operation, there being an angle-block *A*, with two pins *B* for locating the work from the holes previously drilled, and a clamp *C* used to securely hold the work at the upper end, where the milling is done. The opposite end is form-milled by turning the work end for end in the fixture and traversing the cutters across it.

The diagram Fig. 5 shows how the profile milling of the outline, indicated as Operation 3 in Fig. 2, is performed. The forging, shown by dot-and-dash lines *X* at the left in Fig. 5, is

placed over two pins *A* and *B* for locating purposes. It is then clamped in place on the fixture *C* by any suitable method, there being a pad under the work. To the right of the work is shown a formed block *D* having an outline *E* that corresponds to the outline *F* of the work. By using a guide pin *G* in the guiding spindle of a vertical profile milling machine, and causing it to follow the outline of the formed block in the usual manner, the milling cutter *H* is made to traverse the outline of the work. Three cutter positions are shown along the contour of the work.

To mill the contour at the opposite side of the work, the forging is simply turned over on the fixture and the procedure repeated. The illustration shows a plan view, the fixture lying flat on the profile milling machine table.

Operation 4 calls for the drilling of eight small holes, as indicated at *W* in Fig. 1. These are located in a flat templet type of jig, using the same two large holes for locating the work in the jig. A flat type of templet jig is also used for hollow-milling the bosses on the sides.

To perform the next, or sixth, operation indicated in Fig. 2, a gang of cutters consisting of a saw *F* and two mills *G* and *H* are employed. The work is located by two pins in the holes *J* and *K*, and the general type of fixture is similar to the knee type shown in Fig. 4.

After milling through one end, the work is reversed on the fixture and the opposite end is milled through. This operation cuts the forging into two,

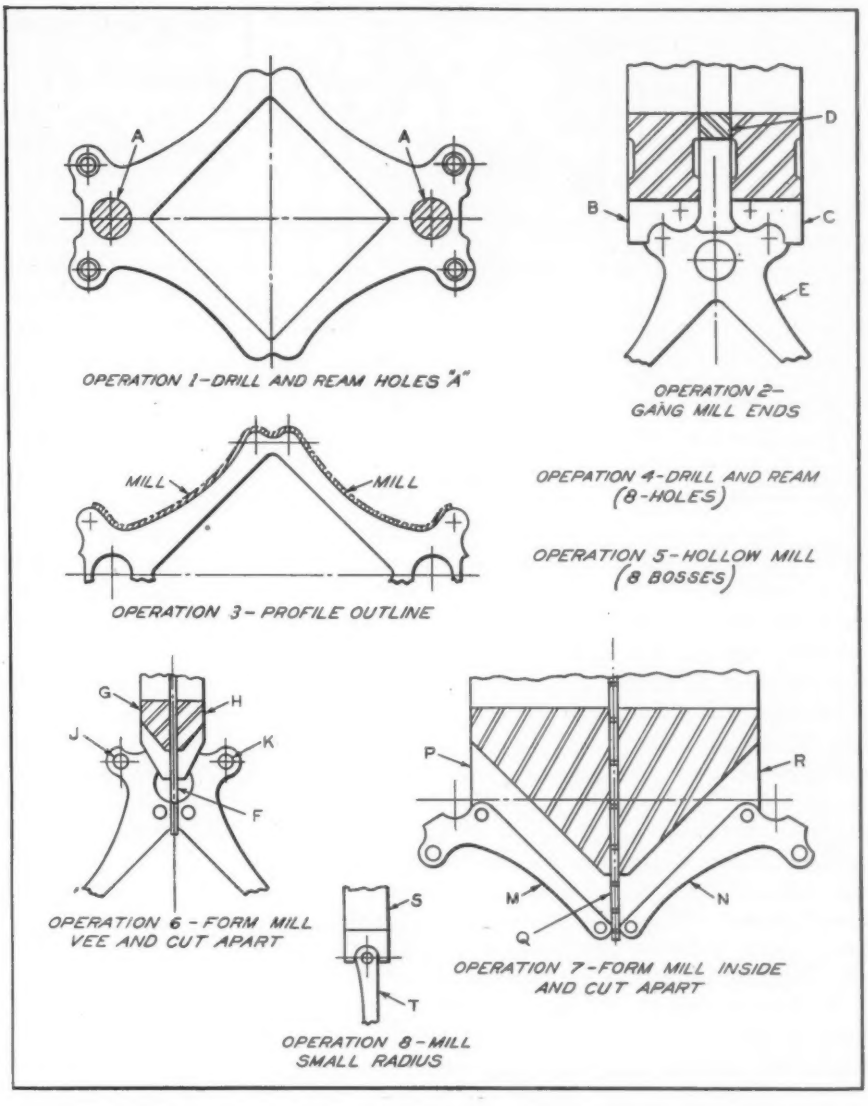



Fig. 2. Views Showing Operation Sequence for Machining Pawl Levers

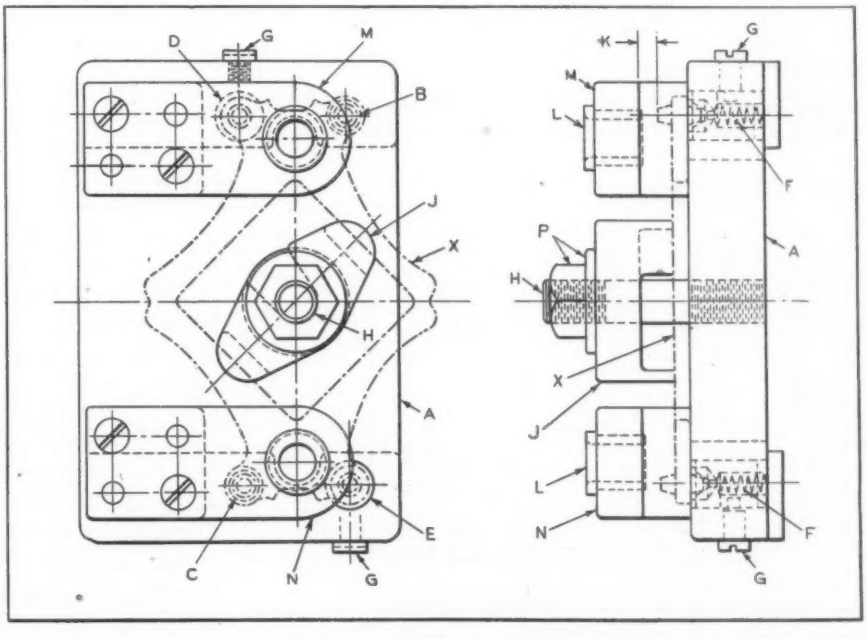



Fig. 3. Jig for Preliminary Drilling Operations on Group Forging

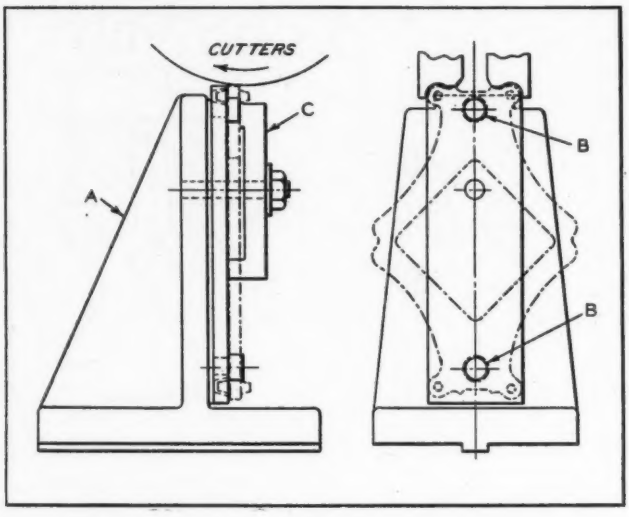



Fig. 4. Fixture for Holding Group Forging while Milling Ends of Two Levers

so that what was previously the inside of the forging can be machined, employing the set-up indicated in Operation 7, Fig. 2. Special heavy work-holding vise jaws are provided for this operation, and each section of the work designated as *M* and *N* is set over locating pins in the jaws. A formed cutter at *P*, a saw at *Q*, and another formed cutter at *R* mill the vee and radius on both sections of the forging, and at the same time, cut it apart to make two trip lever parts. This operation is performed on a horizontal milling machine with the vise and the cutters mounted in the usual relationship.

The final operation on these parts consists of milling the end radius on the long end, the cutter being shown at *S* and the end of the work at *T*. A small angle fixture on a hand milling machine is used for this purpose, the work being traversed horizontally under the cutter.

* * *

Christmas tree ornaments are now being blown from plastics instead of from glass.

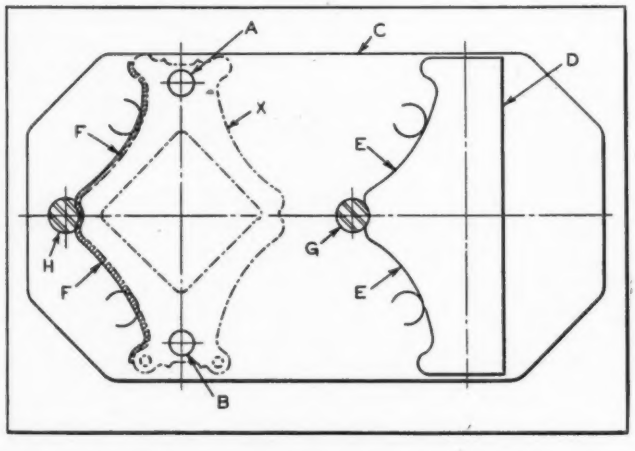



Fig. 5. Fixture Used for Profile-milling Pawl Levers

## Symbols for High-Speed Steel Tools

*Editor:*

The table "Identification Symbols for High-Speed Steel Tools," published as Data Sheet No. 520 in August MACHINERY, gives credit to the Ford Motor Co. and the General Motors Corporation for the development of these identification symbols. Actually several other corporations, associations, and committees were active in the development of these symbols. The Chrysler Corporation should be mentioned, as well as the Technical Committee of the Tool Steel Industry and the Small Tool Manufacturers' Association.

This work had its inception at the General Motors standards department, where it was discussed with the Small Tool Manufacturers' Association. After a tentative agreement had been reached between these two groups, the General Motors Corporation invited the Chrysler Corporation and the Ford Motor Co. to discuss the subject, and these companies agreed to cooperate. Then the Tool Steel Industry was invited to cooperate, and at the General Motors' request, organized a Technical Committee to participate in the discussions and cooperate in this work.

L. A. DANSE, Chairman
General Motors Metallurgical Committee

* * *

## Westinghouse Makes Job Study for Employing War Veterans

Through its experience in employing physically handicapped people during the war years and plant-wide surveys in its twenty-five manufacturing plants and thirty-five manufacturing and repair units, the Westinghouse Electric & Mfg. Co. has learned that in some departments as many as 83 per cent of the jobs can be performed by disabled veterans with limited handicaps. By the middle of August, the company had 1800 war veterans in its employ, all of them disabled in battle or discharged for medical reasons, and the number is constantly increasing.

In an effort to place such war veterans in jobs in which they are most likely to succeed, the company is making a survey which, when completed, will show specifically the physical requirements in each of the hundreds of jobs in the company's plants. The job breakdown is so detailed that when it is completed it will tell at a glance wherever a job requires a man with five fingers to do it or whether it does not necessarily require any fingers at all. It has been found, for example, that a large percentage of the jobs can be performed by men with one leg or by men who must use a cane or crutches.

# *Condensed Review of Some Recently Developed Materials*

## *Arranged Alphabetically by Trade Names*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Lay-out Dye | **Acme Quality Industrial Finish** | A purple semi-transparent lay-out dye, extremely fast in drying. Stock so coated can be scribed with sharp-pointed stylus or similar tool. Dye is quickly removed with denatured alcohol. | Designed to facilitate the making of sharp clear lay-outs on sheet metal. |
| Zinc-blackening Compound | **Alronox** | A process in which Oxidine Z salts are used to blacken zinc by immersion. | Used for blackening and protecting zinc surfaces. |
| Aluminum Bronze | **AMS-4640** | An extruded high-iron, high-nickel aluminum bronze available as Grade 45-22 of Ampcoloy series. Has tensile strength of 95,000 to 105,000 pounds per square inch; yield strength of 50,000 to 55,000 pounds per square inch; and hardness of 207 to 229 Brinell. | Used in aircraft production. |
| Coating for Zinc Surfaces | **Anozinc** | An anodic process which imparts a corrosion-resistant coating to zinc-plated surfaces and zinc-base die-castings. Two finishes are available—a black and a brassy, slightly iridescent yellow. | For protection of zinc surfaces. |
| Weld Spatter Compound | **Anti-Spatter** | A non-inflammable, non-toxic compound. Can be readily applied to joints to be welded and the metal surfaces surrounding them. | Developed to prevent the adherence of weld spatter to metal areas surrounding welds. |
| Aluminized Sheet Steel | **Armco** | An aluminum-coated sheet with mild-steel base combining corrosion resistance of aluminum and strength of steel. Withstands temperatures up to 1000 degrees F. without discoloration. Aluminum coating will not peel or flake off in moderate drawing operations. | Present aircraft applications include fire walls and air-intake filters. |
| Alkali Silicate Finish | **Armor-Vit** | An alkali alumina-silicate finish that is insoluble in boiling water and is highly resistant to many acids, salts, and alkalies. It has high impact and abrasion resistance and is able to withstand severe thermal shock. | Suitable as a protective coating for a variety of metal products that are subject to severe corrosion. |
| Low Phenolic Content Plastics | **BM-15983**<br>**BM-16044**<br>**BM-16325**<br>**BM-16499** | Low phenolic content plastics which can be used for many purposes where it is not necessary to meet exacting Government specifications. | BM-15983 black, BM-16044 brown, and BM-16325 black have been developed for uses formerly requiring general-purpose phenolics; BM-16499 is suitable for work requiring high impact resistance. |
| High-impact Plastic | **BM-16468** | A high-impact resistant molding material with string filler. Impact resistance is twenty to twenty-five times that of general-purpose phenolics. | For plastic products requiring high impact strength. |
| Pattern Repair Material | **Celastic** | A double-nap cotton flannel impregnated with cellulose nitrate and a fire retardant, readily formed into any shape when wet with solvent. Retains shape on drying. Adheres readily to wood, metal, and other materials. | Used for quick repairs and alterations for patterns of metal castings. When so used, can be sanded and shellacked to a smooth surface. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Low Melting Temperature Alloy | **Cerrosafe** | A mixture of bismuth, lead, tin, and cadmium weighing about 0.35 pound per cubic inch, which is completely molten at 190 degrees F. Slight shrinkage during solidification and cooling partially compensated for by subsequent growth. For surface protection, can be applied with low-temperature spray gun. | Suitable for proof-casting of cavities such as molds, gun chambers, and forging dies; for accurate models for engraving machines where stylus pressure is low; and for protecting wood core molds and patterns. |
| Manganese Alloy | **Chace Manganese Alloy No. 772** | A new manganese-base alloy containing over 70 per cent manganese. Has an electrical resistance of 1050 ohms per circular mil foot. Its thermal expansion rate is considerably higher than that of any other strong alloy—about twice as high as for steel. Its thermal conductivity is only 2 per cent that of copper. | Numerous applications are expected in the field of temperature-actuated electrical controlling devices. |
| Alkali Cleaner | **Cleaner 100** | Used in a concentration of 4 to 8 ounces per gallon at 180 to 212 degrees F. It has high detergency and rapid cleaning action at low current densities. It is equally effective in hard and soft water, and forms no insoluble residues due to reaction with acids. | Used for cleaning steel parts. May be used anodically or as immersion cleaner. |
| Plastics | **Colonial V** | A series of three plastics which, when used in place of rubber, are claimed to provide higher resistance to aging, abrasion, sunlight, oils, gasoline, and acids. | Available in the form of tubing, pipe, mono- and multi-filaments, rod, shapes, extrusions, tapes, injection moldings, etc. |
| Plastics | **Compars** | A series of plastics developed to meet the demand for flexible material to withstand the action of toluol, xylol, and benzol. Some of these plastics are chemically entirely unaffected by action of organic solvents; others exhibit low permeability to industrial refrigerant and military gases, high tensile strength and freedom from aging or oxidation. Some varieties remain flexible throughout a temperature range of minus 70 to plus 300 degrees F. Others are insoluble in water at all temperatures. | One of the major applications is hose and hose assemblies to carry gasoline, oils, refrigerant, or other toxic gases. Also used for washers, gaskets, and seals which come in contact with organic solvents. |
| Rust and Scale Removing Compound | **Corrosol 26** | Used in cold solution on metal surfaces. Surfaces so treated are not susceptible to corrosion, but are left in a clean passive condition. | Used to remove rust, scale, and burn marks from machine parts. |
| Rust Preventive and Cleaner | **Cosmoline No. 805** | A fluid compound that acts as a combined rust preventive, finger-print neutralizer, and cleaner. It is not intended to remove rust, but to neutralize the causes of corrosion. Also effective in protecting metal surfaces against corrosion caused by chemical atmosphere, fumes, or high humidity. | For protection of steel parts between processing or machining operations. |
| Rubber and Leather Substitute | **Cotton-leather** | Multi-ply fabric chemically treated to increase its density and durability, and surface-treated to give it a flexible leather-like nature. | Designed for use as a substitute for rubber and leather in such applications as facing belt-driven pulleys, pipe, hose clamps, shock-absorbing blocks, heavy shim stock, etc. |
| Degreasing Solvent | **Cyclodiene Hydrocarbon** | A non-aqueous degreasing solvent which, when applied by dipping, leaves a thin protective rust-inhibitive film that evaporates in about twenty minutes. Is non-inflammable and non-explosive. | For use in connection with plating, painting, Parkerizing, anodizing, and other finishing processes. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Basic Resin | **Duralon** | A basic resin made from waste agricultural products, such as oat hulls and corncobs. It is characterized by low water absorption; insolubility (after activation) in any solvent or combination of solvents; high electrical resistance; absolute stability during storage and handling; and workability. | Offers excellent possibilities as an impregnant, a laminating and bonding agent, and a protective coating material. Definite molding possibilities are also indicated. |
| Plastic Nameplate Material | **Durashield** | A laminated cellulose-acetate plastic material which can be fabricated in various sizes, shapes, thicknesses, and colors. It can be readily engraved or embossed. | Useful as a substitute for brass and bronze nameplates, dial faces, tool checks, etc. |
| Phenolic Casting Resin | **Durez 7421** | A resin that is readily cast at room temperatures through the use of an accelerator. It is a thermosetting material that can also be set by baking for two to four hours at 140 degrees F. It has a compressive strength of 15,000 to 20,000 pounds per square inch. | This phenolic casting resin has been developed for metal-forming dies, jigs, fixtures, etc. |
| Plastic | **Emeloid** | A plastic available in a variety of grades of hardness, elasticity, and toughness. Obtainable in clear form or in a variety of colors. | For making formed, molded, or shaped parts. It can be cut, sheared, sawed, punched, pierced, stamped, polished, drilled, machined, lithographed, and printed. |
| Grinding Wheel Dressing Compound | **Ever-Drest** | A compound that is added to grinding-wheel water to reduce water surface tension and to keep the pores of the wheel open. Intended to prevent burning of the wheel surface. | This compound is suitable for use with organic or vitreous wheels and with hard or soft water. Designed to permit use of closer grained wheels for better finishes. |
| Rubber Strip Substitute | **Fel-Pro** | Synthetic strip material having the spongy characteristic of rubber strip. Is produced by applying Thiokol to specially processed felt base. | Has been used on Army vehicles for tail-gate moldings and is finding numerous industrial applications. |
| Iron Cement | **Fix-Iron** | A powder which is mixed with water and applied without heat. May be hammered into cracks or other openings. After hardening, has same expansion and contraction with temperature changes as iron. | For repairing broken, cracked, or defective metal castings and piping, making joints and seams secure, and stopping leaks in boilers, furnaces, firepots, and other metal equipment. |
| Wire Solder | **Flux-rite** | A wire solder having flux contained in outside longitudinal grooves. The flux is liquefied and flows onto the work before the solder melts, resulting in thorough and complete fluxing. | For general soldering operations. |
| Hydraulic Oil Gum Solvent | **Gum Solvent B** | When used in the proportion of 3 to 5 per cent of oil in a hydraulic system, it dissolves any accumulation of sludge or gum. | For use in hydraulic systems where there is evidence of poor indexing or improper operation. It obviates flushing to clean hydraulic lines. |
| Polishing-Wheel Adhesive | **H-VW-M Adhesive** | An adhesive used in the same way as glue, being heated and applied while warm. Unused material can be reheated without waste. | Developed as a substitute for glue in facing coarse- and fine-grain polishing wheels. |
| Lining for Concrete Forms | **Hydron** | A light, flexible, and easily handled material that aids in producing smoother and harder concrete surfaces by removing water and air bubbles from them. | Used as a lining, consisting of absorptive material faced with a fabric, in concrete forms. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Protective Coating | **Insl-X** | A temporary protective coating for metal surfaces that can be applied by brushing or dipping. The coating is easily stripped off by hand without the use of solvents. | For protection of steel, brass, copper, aluminum, or other metal surfaces. |
| Corrosion-Resistant Coating | **Iridite** | A solution that reacts with zinc or cadmium surfaces to form a uniform, opaque olive-drab coating which considerably increases corrosion resistance. | Suitable for treating zinc- and cadmium-plated surfaces, zinc die-castings, and galvanized steel. |
| Hard-facing Metal | **Kerk-Aloy** | An alloy having unusual qualities of hardness, resistance to wear, thermal conductivity, low melting point, and stability of temper. It has marked ability to bond homogeneously with any metal except lead and aluminum. Can be applied with electric arc or acetylene torch without use of bonding fluxes. | Suitable for hard-facing harrow points, steam-shovel lips, dredge lips, and other equipment where long hard service is the rule. |
| Protective Coating | **Koilkote** | A protective coating that reduces the frequency and length of time required to clean rustproofing system coils. | Intended especially for use on steel coils in rustproofing systems. |
| High-impact Plastic | **Kys-Ite K101** | A wood-pulp Durez resin-impregnated compound with low heat conductivity. It is not affected by temperatures ranging from —40 to +212 degrees F. or by oils, gasoline, ethyl alcohol, acetone, xylol, carbon tetrachloride, and pyridine. | Developed for the manufacture of marine valve handwheels. |
| Plastic Insulation | **Lignin** | A plastic fiber made out of water waste from sulphite-paper manufacture. Produced in the form of paper sheets possessing good electrical characteristics. The material is less corrosive than phenol fiber. It can be easily punched. | Insulating material suitable as a substitute for phenol fiber. |
| Soldering Flux | **Lloyd's No. 6** | A flux with high enough capillary action to make lead-rich solders flow evenly and completely through solder joints. Provides higher tensile strength than previously obtained with 50-50 solders. | Suitable for use with 2 1/2 to 6 per cent silver-lead solders, as well as low-temperature solders. Can be applied in soldering zinc-coated sheet metal, lead-coated sheet metal, tinplate, terne plate, brass, copper, steel, and all types of sweat fittings. |
| Dye for Plastics | **Lucidip** | A dye available in a range of twelve colors, which can be used to color acrylic plastic parts after fabrication. Shades ranging from pastel to dark colors can be obtained. | For dyeing plastic parts by immersion. |
| Plastic Molding Powder | **Lucite** | A new Lucite plastic molding powder that will withstand high temperatures. Many articles made from this powder will not soften appreciably or become distorted at temperatures ranging up to 212 degrees F. This special Lucite has approximately the same optical, electrical, and molding properties as the general-purpose Lucite powders. | For products subjected to relatively high temperatures, such as airplane flying-light lenses, dial and meter faces, medical and dental instruments, and airport and railroad signal-light lenses. |
| Flux for Gas-welding Magnesium | **Mag-Na-Flo** | A flux that is mixed to a thin paste with water and is applied on the metal to be welded with a small brush or to the welding wire by dipping. | Suitable for gas-welding all alloys of magnesium, whether in sheet or extrusion form. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Rubber Substitute | **Marvinol** | A vinyl type thermoplastic that has superior abrasion resistance, withstands constant flexing without fatigue, and is impermeable to gases and liquids. | Used to make automobile tire inner tubes and industrial gloves. |
| Stop-off Lacquer | **Miccrome** | A lacquer that can be applied by brushing, dipping, or spraying. It dries rapidly in the air, and can be readily removed by peeling or dissolving. | Specifically developed for the masking of parts for hard chrome plating. |
| Solvent for Protective Coatings | **Miccrostrip** | A non-toxic solvent that contains no acids and will not affect any metal finish. | Useful for removing lacquer employed to mask parts for hard chromium plating or selective hardening. |
| Gage and Die Protective Compound | **Micronoil** | A liquid which, when applied to surfaces or edges of gages for precision measurement, greatly increases their wear resistance and thus helps to maintain accuracy over extended periods. | For treatment of gages, precision dies, taps, punches, and reamers. |
| Soldering and Tinning Flux | **Mogul** | This flux has a lower melting temperature than soft silver solder on initial heats. When once activated, it will work at temperatures slightly higher than those used for regular 60-40 solder. | Used for the soldering and tinning of a wide range of metals, including cast iron, steel, aluminum, and copper. |
| Silver Babbitts | **No. 367**<br>**No. 397** | Two grades of lead-base babbitts containing silver and having physical characteristics comparable to those of tin-base babbitts. They retain hardness at elevated temperatures, are easily bonded, resist squeezing out, and have a high degree of corrosion resistance. | Can be employed as substitute for tin-base babbitts. |
| Stop-off Paint | **No-Kase** | A protective coating that can be applied by brushing, spraying, or dipping. | Can be used as a stop-off paint for selective carburizing in a liquid carburizer. |
| Protective Wrapper | **No-Ox-Idized Wrapper** | A tough, moisture-proof wrapping material made of cellophane film, laminated to a light cotton fabric and impregnated with moisture-proof materials. | Developed to save time usually required for cleaning off grease or other rust preventive compounds from products after delivery. Can be sealed by twisting ends of package or by a heat sealing device. |
| Weld Spatter Material | **No-Spat** | A liquid that prevents the adhesion of welding spatter. | Is brushed over the seam and area where weld spatter is likely to fall. |
| Latex Insulation | **Nubun** | This synthetic-rubber insulation has high flexibility, impermeability to water and high dielectric strength. | Intended for the insulation of power, lighting, and communication cables. |
| Plastic | **Nylon** | A thermoplastic with a high softening point of 450 degrees F. It is of light weight, burns slowly, undergoes little or no deterioration with age, and is only slightly affected by sunlight. It resists oil, grease, solvents, alkalies, and weak acids. Can be easily machined. | Two potential applications are bearings and coil springs. |
| Detergent | **Oakite No. 86** | An acid type, two-function detergent which removes oils and dirt and imparts a microscopic crystalline coating to work surfaces. This coating provides a basis for the firm bonding of a paint or lacquer coat, and resists rusting. | Used as a cleaning, paint and lacquer bonding, and rust preventive compound for steel parts. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Anodic Degreasing Material | **Oakite Composition No. 90** | A cleaning agent with high conductivity, ready adaptability to hard water conditions, effective smut removing properties, and fast wetting-out action. Particularly effective where large volume of work is handled and fast soil removal is essential. | Intended for anodic degreasing of cold-rolled steel parts before finishing. Has been found advantageous in plating departments and contract finishing shops using Bullard-Dunn process for coating steel. |
| Synthetic Rubber Plasticizer | **Paraplex G-25** | A synthetic resin having high resistance to oils, gasoline, and heat. | Has shown promising results as a plasticizer in polyvinyl chloride cable compounds and cable lacquers, wire enamels, vinyl resin fabric coatings, hot-melt compositions, aircraft gaskets, and sealing compounds. |
| Metal Finishing Compound | **Pentrate** | A salt mixture that imparts a black oxide film having marked anti-friction and anti-rust qualities. | For application to ferrous metals such as small aircraft-engine parts. |
| Impregnated Plywood | **Pluswood** | A resin-impregnated plywood having a specific gravity of 1.3 to 1.4, tensile strength of 32,000 to 40,000 pounds per square inch, compressive strength up to 40,000 pounds per square inch, and impact strength (Izod) of 6 to 8 pounds per inch of notch. | For structural applications and, where conditions permit, for use as a metal substitute. It can be sawed, drilled, turned, threaded, milled, and tapped with metal-working tools. |
| Water Absorbing Oil | **Polar R** | A light oil having the property of removing perspiration, water, oil, and dirt from iron or steel surfaces. Is completely soluble in hydrocarbons and lubricating oils. | Intended for dehydrating and cleaning steel surfaces, bearings, or similar parts that have become wet. Especially applicable for protecting steam turbines, water pumps, and meters. |
| Plastic | **Polythene** | Flexibility and toughness over a wide range of temperatures, unusually good resistance to water and moisture penetration, chemical inertness, and excellent electrical characteristics. | Can be utilized for various types of containers, gaskets, and battery parts, flexible tubing or more rigid piping, waterproof and chemically resistant coatings, and adhesives. |
| Corrosion Protective Compound | **Pore-Pac** | A treatment for protecting castings, in which casting is immersed in a solution of gums at about 350 degrees F. This is followed by heating to 200 degrees F. | Castings are protected against corrosion and penetration by oils at temperatures under 150 degrees F. |
| Protective Hand Cream | **Pro-Tek** | A greaseless hand cream which forms an invisible film that protects the skin against contaminated oils and other irritating substances. Can be readily removed with soap and water. | Useful in plants where workers' hands are exposed to oil, grease, solvents, or paints. |
| Protective Coating for Finished Surfaces | **Protektol** | A transparent removable coating applied by spraying, brushing, dipping, or roller coating. One gallon covers about 250 square feet. Drying time at 200 degrees F., six to eight minutes. | Suitable for use on finished metal and ceramic surfaces to prevent product rejection due to rust, surface scratches, shop wear, grease, and dirt. Being transparent, visual inspection of surface covered is possible. |
| Motor Balancing Compound | **R-943** | A paste or soft putty compound applied easily with the hands or a knife. | Used for balancing electrical motor armatures. |
| Bonding Compound | **Reanite** | A compound that, when applied by brushing, spraying, or dipping to surfaces of like or different materials, results in an exceptionally strong bond after low heat and pressure are applied. Tests show metal-to-metal joint strength comparable to riveting or spot-welding. | For bonding metal to metal, rubber, plastics, leather, wood, or any of these materials to each other. It is being used for airplane sub-assemblies, motor mounts, and composite metallic and plastic units. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Low Tin-Content Babbitt | **Rex** | A low tin-content babbitt having a tensile strength of 8200 pounds per square inch; elongation, 1.2 per cent in 2 inches; reduction in area, 1.8 per cent; compressive strength, 17,500 pounds per square inch; and pouring temperature, 625 to 675 degrees F. | Suitable as a substitute for high tin-content babbitts, necessitated by compliance with government tin conservation order M-43-a. |
| Fluid for Metal Marking | **Rives Metal Marker** | A fluid which provides a permanent marking that does not wash or rub off. Is applied with ordinary rubber stamp. | Original formula intended primarily for marking most ferrous metals and copper. |
| Rust Preventive Compound | **Ru-Pre-Sol** | A rust preventive compound that dries on the surface of the work to form a tight but invisible protective film. | Used as an addition to water-soluble cutting oils. |
| Rust Preventive | **Rust Veto 110A** | An amber-colored liquid, applied by brush or spray, that dries to a hard, transparent coating, flexible at temperatures ranging down to —70 degrees F. When dry, the coating is non-inflammable. It adheres firmly to metal even after 24-hour water immersion. | Used to protect various metal surfaces against oxidation. |
| Brazing Flux | **Scaiflux 21** | A brazing flux with low melting point and low surface tension. | Suitable for brazing any type of ferrous or non-ferrous alloy. |
| Cutting Lubricant for Glass | **Sinszine** | A lubricant that aids in rapid, smooth drilling and promotes longer tool life. | For drilling glass. |
| Ladle Inoculation Alloys | **SM**<br>**SMZ** | SM ferrochrome alloy supplies chromium additions to iron or steel in the ladle. SMZ alloy contains silicon, manganese, zirconium, and iron. It provides an economical and efficient means of obtaining a machinable, high-strength gray iron from a low-silicon white iron, or for producing an improved gray cast iron by a ladle addition. | Used as a ladle inoculation for the improvement of cast iron and the addition of chromium to iron or steel. |
| Insulating Varnishes | **Speedairbonds** | A group of air-drying insulating varnishes that quickly dry to a smooth glossy finish. They are oil-proof and extremely water-, acid-, and alkali-resistant, and have high dielectric qualities, flexibility, and long life. | For use in the manufacture and repair of electrical equipment. |
| Magnesium Fire Extinguisher | **Speedi-Out** | A hard coal tar pitch that is non-abrasive, non-corrosive, and non-toxic. Produced in a granular form with a 6/35 mesh that has a softening temperature exceeding 300 degrees F. | Intended for extinguishing magnesium fires and incendiary bombs. After the fire has been put out, the dry pitch can be readily chipped off. |
| Hardening Solution | **Steel-Temp** | A hardening solution for tool steel that gives improved results over ordinary quenching methods, while at the same time imparting toughness. Makes additional tempering operations unnecessary. | Can be used in the hardening of water- or oil-quenching steels. |
| Hard-facing Alloys | **Stoody 1**<br>**Stoody 6** | Two hard-facing alloys of cobalt, chromium, and tungsten. Stoody 1 provides high resistance to abrasion, corrosion, and heat; Stoody 6 is much more ductile and provides greater resistance to impact. | Stoody 1 is recommended for hard-facing pump sleeves, wood-saw teeth, carbon scrapers, wire guides, expeller parts, etc. Stoody 6 is useful for hard-facing high-pressure, high-temperature valves, gasoline and Diesel engine exhaust valves, guides, shear blades, cams, etc. |

## *Review of Some Recently Developed Materials—Continued*

| Class of Material | Trade Name | Properties | Applications |
|---|---|---|---|
| Temperature Indicating Compound | **Tempilaq** | A temperature-indicating compound that dries immediately upon application and melts when a stated temperature is reached. Available in a range of compositions for indicating any temperature from 125 to 350 degrees F. in 25-degree intervals, and from 350 to 1600 degrees F. in 50-degree intervals. | Developed especially for use on polished surfaces, on the inside of tubes or castings, and on other inaccessible places, such as overhead surfaces. |
| Compound for Treating Galvanized Surfaces | **Turco Redi-Paint** | A compound that roughens galvanized surfaces, neutralizes any surface alkalinity, makes the metal passive, and forms a corrosion-resistant film. | For preparing galvanized metal surfaces so that paint will adhere to them permanently, without chipping or peeling. |
| Corrosion Resistant Compound | **Tygon** | A synthetic compound resistant to practically all inorganic and organic acids, salt solutions, and alkalies. Unlike rubber, which it resembles in many characteristics, it is unaffected by oxidizing agents and many hydrocarbons. No heating, baking, or vulcanizing is required. | Available in three forms — patent-leather like material suitable as a lining for process equipment; a resilient compound that can be formed into flexible sheets, tubes, and molded goods; and a liquid that can be sprayed, dipped, or painted on surfaces. |
| Synthetic Rubber | **Uskol** | A sixth major type of synthetic rubber having a high degree of solvent resistance. | Intended for use in the manufacture of products that come in contact with fuels, oils, gasoline, dry cleaning fluids, and chemicals harmful to natural rubber. When applied to paper and cardboard, it renders them resistant to grease, water, and chemicals. |
| Plastic Resin | **Vinsol** | A resin powder which, when added to various cellulose fibers, provides a thermoplastic fibrous resin composition that is hard, dense, stiff, and has considerable toughness. It is of light weight and has low water absorption. | Suitable as a substitute for steel or other metals in food containers, automobile license plates, certain types of conduits, and cement-filled columns supporting light loads. |
| Synthetic Insulation | **Vinylite** | A synthetic material available in various forms as extrusion compounds or as a film compound supplied in the form of tape. It has superior aging properties, is highly resistant to normal weathering conditions, has low moisture absorption, and high dielectric and tensile strength. One type is flexible at temperatures down to minus 50 degrees F. | As extrusion compounds can be coated on wire or cable cores to form a uniform insulating wall of desired thickness. Can also be fabricated in the form of tubing for use as over-all jacket or duct. As tape, is used as an insulation wrapping. |
| Vinylite Resin | **Vinylite Resin VMCH** | This resin is characterized by improved adhesion to wide variety of surfaces, making possible formulation of air-dry or low-bake coatings possessing resistance to corrosive chemicals, moisture, and extreme weathering comparable to that shown by baked finishes based on Vinylite vinyl chloride-acetate resins. | Developed for use in corrosion-resistant finishes, such as air-dry coatings for maintenance work; coatings for industrial buildings and equipment exposed to corrosive atmospheres; coatings and linings for storage tanks to hold petroleum products, acids, chlorides, and similar corrosive materials; coatings to withstand prolonged water soaking or extreme weathering. Suitable for application over magnesium and aluminum alloys, particularly when subjected to salt-water immersion. |
| Silver Solder Flux | **XCel-Flux SS** | A silver solder flux that has a breaking point of about 920 degrees F. and is completely fluid at 1065 degrees F. | In use, it throws off a green transparent flame that does not obscure the work. |

# The Use of Rubber in Conjunction with Press Tools

## Effective and Economical Methods of Producing a Wide Range of Sheet-Metal Parts — Second of Three Articles

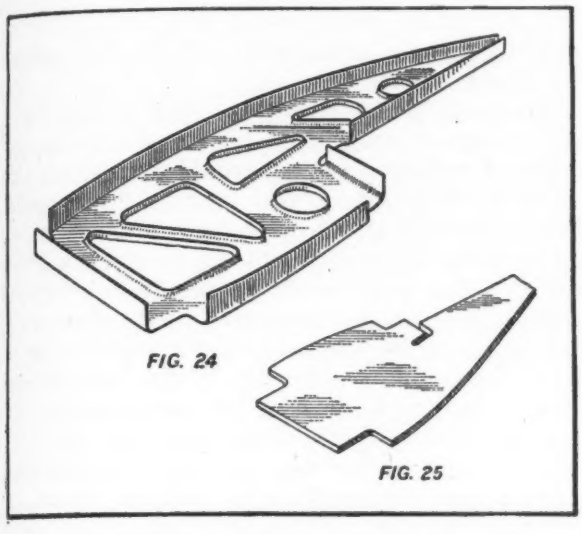



Fig. 24. A Typical Airplane Rib Designed for Rubber Pressing. Fig. 25. First-stage Blanking Tool for the Rib Shown in Fig. 24

IN the first article in this series, the properties of rubber that affect its use in connection with press tools were discussed, and the manner of its application was explained. Some shearing operations performed with the aid of rubber were also considered. In this article, the use of rubber for blanking and piercing operations will be dealt with.

There are, of course, a number of factors that must be considered before a decision is made as to the choice of a method for producing an article. Blanking and cutting out by the rubber press method does not lend itself to economical results in production, except from the labor and toolmaking point of view, especially in the case of small parts. This applies, of course, to "clean" cutting.

Clean cutting calls for a marginal allowance, which may amount to as much as 3/4 inch in handling duralumin 0.036 inch thick on a 2-ton press. Assuming that the cut-out form is about 2 inches across, then a scrap figure of about 37 per cent has to be reckoned with. In cases where large numbers are required, such wastage would speedily nullify any saving achieved by dispensing with an ordinary press tool.

Another factor to be considered is time. The hydraulic press, which is usually associated with rubber press work on account of the high pressure necessary, is far slower in operation than an ordinary power press, and unless a number of jobs are handled simultaneously, the time lost by the use of the hydraulic press would probably offset the saving effected by employing less expensive tools. It would be as well, however, before the reader begins seriously to wonder if the use of rubber has any real advantages at all, to stress the fact that the preceding remarks apply only to small parts.

Consider for a moment the advantages of the use of rubber in the production of a component such as a main plane rib with overall dimensions of, say, 5 feet by 1 foot 6 inches. A combined blanking and forming tool for use on an ordinary power press would be difficult and very costly to produce. With the rubber pressing method, however, the problem is greatly

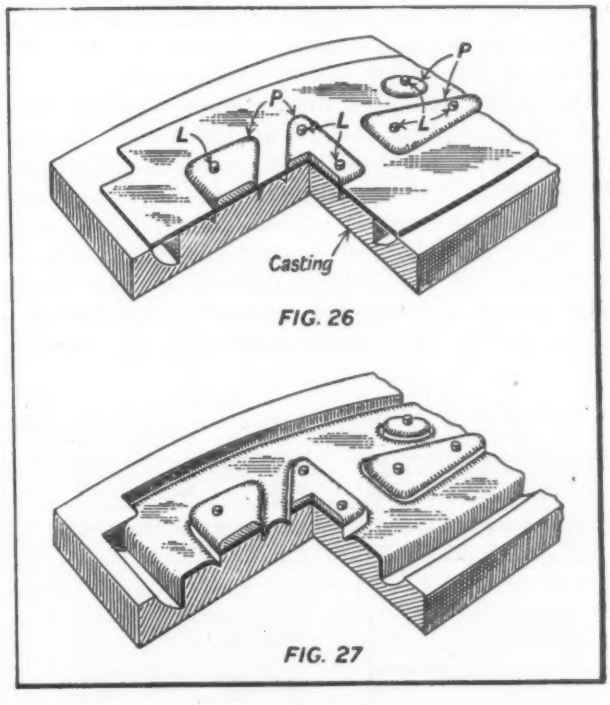



Fig. 26. Second-stage Blanking and Flanging Tool for the Rib Shown in Fig. 24. Fig. 27. Blanking and Flanging Tool with Finished Work in Position

simplified, since only two or three simple castings are required.

A typical rib designed for two-stage production by the rubber pressing process is shown in Fig. 24, while Fig. 25 shows the blanking tool for the first stage, which is made from mild steel, 0.125 inch thick. This tool is merely a developed templet, and in this particular case, it is sufficient if a little cleaning up is done at the edges, which are subsequently to be bent. The tool is placed flat on the bed of the press with the material to be blanked on top of it, and pressure is then brought to bear.

Fig. 26 shows the combined blanking and flanging tool for the second stage. The pressure pads *P* are provided to insure clean cutting. The first-stage blanking tool can be used as a templet for drilling the holes for the locating pins *L*. The completed rib is shown in position on the tool in Fig. 27.

### *Advantages of a Rubber Press for Piercing*

In blanking or piercing on an ordinary power press, it is only necessary to calculate the energy requirements to overcome the shear resistance of the metal to be worked, that is, strength of material × area to be sheared. From this formula, sufficient information can be derived as to the size of press needed, allowances being made for shock and other factors.

This calculation could not be applied in determining the capacity of press needed for rubber press work, since the work is completed in a very brief portion of the press stroke in the one case, whereas continuous pressure is the vital factor in the other.

With the ordinary blanking or piercing tool, the whole of the energy available can be concentrated at the point where work is to be done. With the rubber pressing process, however, due to the nature of the medium employed, the pressure must be built up until it is sufficient to overcome the resistance offered by the work. This pressure, moreover, cannot be applied at a given point, but must necessarily be exerted over the whole area with which the rubber comes into contact.


Fig. 31. Comparison of Effective Pressure Areas for Ragged and Clean Cuts

The main plane rib, measuring 5 feet by 1 foot 6 inches, mentioned previously as an example of rubber pressing, would necessitate the use of a rubber pad 6 feet long by 2 feet wide. Thus, assuming an effective force of one ton per square inch, a press capable of exerting a pressure of 1728 tons would be required. Presses capable of exerting pressures up to 5000 tons and providing an effective working area of rubber of 3000 square inches are in use for airplane work. Over such an area, pressures up to 1.66 tons per square inch can be obtained.

Reverting to the problems incident to piercing, assume that a clean hole, 1 inch in length by 1/8 inch wide, is to be punched in a duralumin sheet 0.022 inch thick.

The area of metal to be sheared in this instance is found to be 0.05 square inch, and assuming the shear strength of duralumin to be 15 tons per square inch, it will be necessary to apply a force of over 0.75 ton. There is, however, an area of only 0.125 square inch on which to operate (this statement should be taken for granted here and will be explained later), so that a pressure of 6 tons per square inch is required to bring about the desired collapse of the material.

This is an example of a job that is quite simple on an ordinary press but impractical on the rubber press. It was chosen to emphasize the consideration that must in all cases be given to

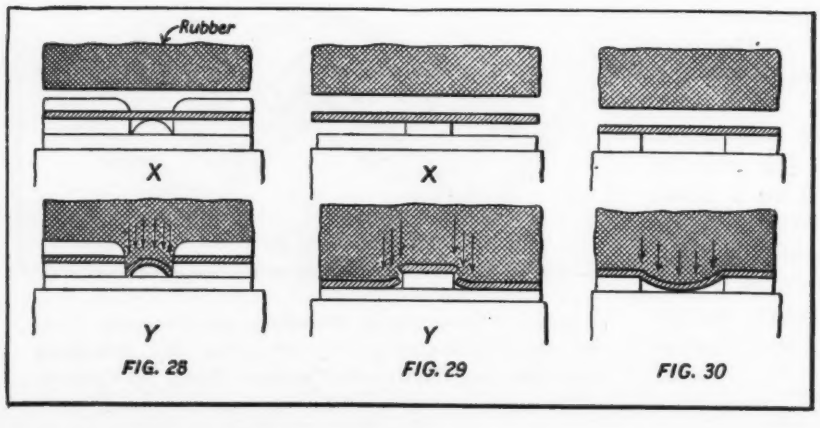



Fig. 28. Arrangement for Blanking Clean Holes. Fig. 29. Blanking Arrangement Giving a Larger Effective Pressure Area, but Resulting in Rough Edges. Fig. 30. Set-up for Blanking which will Result in Torn Edges

small details before decisions are reached as to whether a job is suitable for production by rubber pressing and the methods to be employed.

It may be noted that a press capable of exerting a pressure of 2 tons per square inch would not have quite sufficient capacity to punch out a clean hole with a diameter of 5/8 inch in a duralumin sheet 0.022 inch thick.

Emphasis has been laid on the word "clean," as where circumstances permit, it is possible to pierce a smaller hole in the same material, provided there is no objection to a ragged edge. Figs. 28 and 29 illustrate this point.

Assume that it is desired to punch a hole 1/2 inch in diameter in a piece of duralumin 0.022 inch thick. In a correct set-up for clean shear, as shown at *X* in Fig. 28, the effective pressure area (denoted by arrows at *Y*) is 0.197 square inch. To pierce the hole, a pressure of 2.6 tons per square inch would be needed.

On the other hand, a set-up such as shown at *X* in Fig. 29 would, for the same size hole, give an effective pressure area (see arrows at *Y*) of about 0.6 square inch, and a pressure of only 0.86 ton per square inch would be sufficient to cause the collapse shown.

At this point, reference may be made to the subject of effective, or working, areas. In Figs. 28 and 29, it will be seen that the arrows denoting pressure are placed immediately above the unsupported portions of the work. Obviously, despite the fact that pressure is being applied throughout the whole of the rubber mass, the resistance offered by the solid sections of the set-up must neutralize any effort exerted by the mass at the areas of contact. It follows that, in calculating the pressure required to accomplish any cutting operation, all reckonings must be based on the area of unsupported metal, an area dependent on (a) the type of cut desired, that is, clean or rough, and (b) the gage and nature of the metal being worked. In using a press with a rubber pad and applying a pressure of 2 tons per square inch, the area may, for practical purposes, be taken as being equal to that of a strip varying from 1/8 to 3/8 inch in width along the line of the cut.

The temptation to gain extra effective working area may give rise to the situation illustrated in Fig. 30. This is a set-up to be avoided, since it introduces the conditions illustrated in Fig. 17 (September MACHINERY, page 174) and instead of a clean cut, tearing will be the outcome. The heavier the gage of the metal to be worked, the greater is the effective area available, as there is less tendency for the metal to become bent or distorted. Fig. 31 shows some examples of effective areas available for various cuts, the solid lines representing the cuts and the shading the effective areas.

# The Fields for Plastics and Metals

IN an article recently published in *Metals and Alloys*, a comprehensive comparison is made of the fields for plastics and metals in post-war industry. Obviously, there are a large number of structural applications for which metals only can be used; on the other hand, there are a great many applications in the decorative field where plastics only would be considered. Then there is a twilight zone where plastics and metals overlap: (1) Molded plastics can replace die-cast, sand-cast, and machined metals; (2) laminated plastics can replace metal made in sheets, whether formed or machined; (3) resin coatings can replace metals used for plating.

Plastics have their superior points and their limitations. They are superior for electrical insulation; for waterproofing textiles without impairing their flexibility; for transparency; for protection against ordinary heat conduction at comparatively low temperatures; for uses where the material should be comfortable to the touch; and for cases where "built-in" colors are desirable. Furthermore, neither corrosion nor electrolysis affects plastics.

On the other hand, plastics cannot be used where continuous heat above 400 degrees F. will be applied. They lack the surface hardness of metals, although some of them withstand abrasion better than certain metals. In many applications, only metals have sufficient strength. Plastics cost more than metals on a pound basis, but this is often offset by their light weight. Even magnesium, with a specific gravity of 1.80, is heavier for equal volumes than plastics, the specific gravity of which varies from 1.06 to 1.50.

As to tensile strength, aluminum alloys run as high as 60,000 pounds per square inch, against 30,000 pounds for the strongest plastics, but in compressive strength, plastics are better pound for pound. They are not suitable when considerable shear strength, impact, or flexural strength is required; but against this, it can be said that there are thousands of applications where the strength of metals is not required.

The resistance of plastics to abrasion is a strong point in their favor. It is said that ammunition chutes of laminated phenolic plastics have outworn steel chutes; and some plastic gears outwear steel, besides being quieter. Plastics will also dampen vibration better than metals.

# Conservation of Materials by Rust Prevention

By M. S. CLARK, R. B. THURSTON, and ALLEN F. BREWER
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VARIOUS estimates have been made as to the value of the metals rendered useless annually through rust and corrosion. Obviously, it is extremely difficult to arrive at any reasonably accurate figure; but the fact remains that rust and corrosion consume and destroy enormous quantities of iron, steel, and other metals annually. At this time in particular, when every effort is being made to conserve materials of all kinds, methods of rust prevention are more important than ever.

It is obvious that rust and corrosion should be prevented in as far as possible throughout the entire life of the material. This means that steel should be protected from the time it is passing through the final stage in the rolling mill until it is discarded as junk. As a matter of fact, the most critical stage of a steel surface is when it is first cooled to room temperature in the steel mill. It is cleaner chemically at this time than it ever will be afterward, and is therefore more susceptible to oxidation or rust.

### *Different Methods of Rust Prevention*

The main function of a rustproofing material is to prevent the oxidation that takes place so easily at normal temperatures in the presence of moisture or high humidity. A limited amount of protection can be provided for materials in storage by control of the humidity and temperature. In fact, if the surfaces of iron and steel can be kept absolutely dry, no rust will ever develop, because moisture must be present to complete the oxidizing reaction.

There are four general methods of rust prevention:

1. Using rust-resistant metals, such as stainless steels.
2. Controlling the rust-forming influences by (a) regulating the humidity; (b) preventing contact with corrosive chemicals; and (c) eliminating stray electric currents.
3. Chemically changing the surface of the steel so as to make it corrosion resistant.
4. Protecting the metal with suitable coatings, such as (a) metal plating, (b) hard-drying paints, or (c) non-drying petroleum-base materials.

In the present article, we are concerned only with the fourth of these methods—that of protecting the metal with a suitable coating. Permanent structures are usually coated with either hard-drying paint or a petroleum-base material. Sheet steel in storage or in transit is most often protected by some type of oil. Machined steel parts are generally coated with heavy petroleum compounds that can be removed without much difficulty when necessary.

Drying is desirable prior to the application of any rust-preventive material. Moisture is especially likely to be present when any drying operation is carried out by direct contact with live steam. Under such conditions, the final treatment should be drying with hot dry air to remove any traces of moisture.

The application of rust-preventive oils is simple. In steel mills, these oils are frequently applied with felt rollers after the last rolling and cleaning operation. In machine shops, steel parts are usually dipped into rust-preventive oils at the completion of each machining operation. Parts too large for this procedure can be coated by brushing or spraying.

Heavier types of compounds are applied according to their consistency. They may require heating before application, however, and are particularly suitable for use in connection with a dipping operation when relatively permanent protection is desired. The lighter grades of rust-prevention compounds are generally brushed or sprayed on the steel surfaces.

### *Types of Oils and Compounds Used for Rust Prevention*

Four types of petroleum-base rustproofing materials are used: (1) Straight petroleum oils; (2) specially prepared rustproofing oils; (3) heavy non-drying compounds; and (4) hard-drying coatings.

The straight petroleum oils are usually well refined lubricating oils containing no fatty oils or other added materials. Either a paraffin- or naphthene-base oil can be used with good results. Light oils having a viscosity of from 85 to 250 seconds Saybolt universal at 100 degrees F. are used chiefly for the temporary protection

of sheet steel. They furnish good rust protection and lubrication between the sheets in a stack, although they do not give complete protection to the steel against rusting in the presence of moisture. Water coming in contact with the steel, even after it has been oiled, will tend to penetrate a straight mineral oil film and cause rusting, sometimes in a few hours.

Because of the limitations of these oils, special products have been developed for many purposes. Straight mineral oils are suitable only when the steel is stored in a place where the conditions conducive to rusting are not severe and where the steel is protected against atmospheric condensation due to temperature changes. It is usually true that the heavier the oil, the better the protection; but no straight mineral oil will give long-time rust prevention.

### *Special Rustproofing Oils*

Many rustproofing oils are composed chiefly of petroleum lubricating oils, with or without volatile thinners, to which have been added small amounts of other protective materials. When a thinner is used, it acts merely as a solvent which reduces the viscosity and aids in uniformly spreading a thin layer of the rust-preventing material. The special rustproofing oils range from a very low viscosity, say around 35 seconds Saybolt universal at 100 degrees F., up to very heavy grades of cylinder oils.

Certain materials of a non-petroleum nature, if present in the necessary predetermined quantities and prepared in the proper manner, add to the rustproofing qualities of petroleum oils. The selection of these additives has been the subject of a vast amount of careful research. Fatty oils give increased adhesiveness to the rustproofing oil. They also tend to form emulsions with any moisture that may be present, thus keeping water from wetting the steel surface and causing rust. Certain fatty oils, however, upon long contact with metal, are not entirely stable. They tend to oxidize and form fatty acids, which are definitely harmful. When thinners are used, their flash point should be sufficiently above room temperature to prevent any fire hazard.

These special rustproofing oils are particularly useful when the storage conditions are such that the steel surfaces are exposed to atmospheric temperature changes or when shipments have to be made in the winter under conditions of extreme temperature and humidity. However, they are not intended for protection under outdoor atmospheric conditions, although the better grades will give limited protection. They will give long-time protection to steel that is not exposed directly to the elements, and will give much better service in this respect than a straight mineral oil.

### *Heavy Non-Drying Rustproof Compounds*

The group of heavy non-drying compounds used for rust prevention includes those petroleum compounds that are relatively viscous and non-hardening, but that can be applied with a brush or heated for a dipping operation. They produce a non-hardening film that is waterproof, and hence capable of effectually preventing rust. Some of these materials are even able to penetrate existing rust and prevent further deterioration of the metal underneath. Most of these compounds can readily be removed with a solvent such as kerosene.

These compounds are especially suitable for steel that is to be stored or shipped under unfavorable weather conditions. They are also adapted for the protection of steel structures, such as bridges, farm equipment, or any steel directly exposed to the elements. A satisfactory compound should be capable of being easily applied; it should give effective protection of the surface when in contact with air and moisture; it should be easy to remove when rust protection is no longer required; and it should be safe from fire hazard.

With regard to application, the following points may be observed: Objects that are dipped when cool or for an insufficient length of time may be coated too heavily. Objects dipped for too long a time at too high a temperature may be coated too lightly. In other words, the film thickness depends on the size and temperature of the object to be coated, the temperature of the bath, and the length of immersion.

The lighter grades of these compounds are applied by brushing or swabbing at ordinary summer temperatures. The heavier grades are frequently "cut" with a solvent to enable them to be applied with a brush. Many of these products are easily diluted with petroleum solvents to a consistency suitable for spraying. When the solvent has evaporated, a rust-protecting film remains of the same quality as that obtained by hot dipping.

When a rustproof compound is applied over existing rust without chipping, filing, or grinding to obtain a clean surface, a thicker application is necessary, so that some of the rustproof compound can penetrate the layer of rust. In that case, it will function as a preventive of further rusting. Whenever possible, however, heavy rust should be removed thoroughly by chipping or grinding before the metal is treated.

The safety factor is particularly important. Whenever heating is necessary to obtain the fluidity required to permit dipping, swabbing, or spraying, the flash point should be well above the maximum temperature to which the compound is heated. Obviously, the heavier the compound, the higher the preheat temperature may have to be. In the case of materials applied

cold and containing solvents, the flash point should be above 100 degrees F. It should be observed that these compounds, since they do not dry, will cause slippery floors if spilled.

### *Hard-Drying Coatings*

Hard-drying coatings are usually employed for semi-permanent coverage of outside steel surfaces for extended periods of time. Normally, such materials are either paints or non-oxidizing asphaltic materials. These hard-drying coatings generally contain thinners to facilitate application. When the thinners evaporate, a hard tough surface results, which is reasonably resistant to wear and weather. The length of protection afforded by these materials varies widely according to their character and the weather to which the protected surfaces are exposed.

The war has greatly speeded the development of rustproofing products and improved methods of application. There is now a sufficiently wide range of rustproofing materials to assure protection for practically every type of surface.

* * *

## Training Courses in Maintenance and Repair of Industrial Instruments

Training courses in the maintenance and repair of industrial instruments are being conducted by the Brown Instrument Co., 4485 Wayne Ave., Philadelphia 44, Pa. The courses will pertain to mechanical potentiometer pyrometers, electronic potentiometers, electrically operated automatic controls, flow meters, thermometers, pressure gages and hygrometers, air-operated automatic controls, and other instruments. Additional information can be obtained from the company.

* * *

## Plant Management Conference

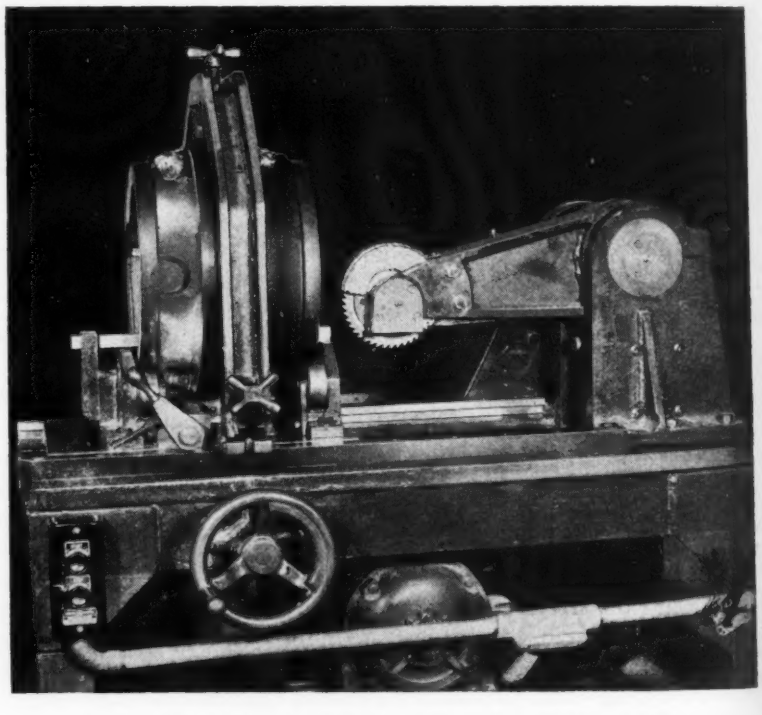
A four-day Plant Management Conference under the auspices of the National Metal Trades Association was held September 10 to 13 at the Sagamore Hotel, Lake George, N. Y. Among the subjects dealt with were procedures in the re-employment and rehabilitation of service men, the working of the National War Labor Board, job and salary rating, stabilization requirements, over-time and holiday pay requirements, and what foremen should know about the Labor Relations Act.

## Power-Driven Saw for Cutting Babbitt in Bearing Linings

The power-driven saw shown in the accompanying illustration was designed and built at General Electric's Pittsfield Works to simplify and speed up the operation of cutting the babbitt in bearing linings for large motors. The cut is made from the inside, separating the babbitt bearing lining into halves after it has been cast in the bearing. The rotating cradle serves to hold the bearing in place for the cutting operation.

The bearing is rotated until one of the slits for dividing it into two is lined up with the saw by means of a bar guide. The rotating cradle is mounted on slides, enabling the operator to feed the bearing into the saw by means of a handwheel. A gage serves to limit the saw cut to the desired depth, so that it will just cut through the babbitt without touching the steel bearing itself. After the first cut is made, the piece is revolved 180 degrees and the cutting operation repeated.

Substantial reduction in the time required for the cutting operation has been obtained by providing a clamping mechanism for holding the bearing which can be quickly applied and by making provision for easy rotation of the bearing without requiring the use of a crane. The saw, driven by a 1-H.P. motor through gearing, takes a smooth, accurate cut.



Bearing Lining in Indexing Clamping Device with Bar Guide in Place, Ready for Taking One of Two Cuts which Separate Babbitt into Two Half Sections

# Machining Steel Parts on Automatic Screw Machines with Carbide Tools

EXPERIENCE has shown that carbide-tipped tools will give excellent results in machining both carbon and alloy steels in automatic screw machines. Production can be increased, unit costs reduced, and tool life prolonged. Certain basic rules, as stated by Carl W. Blade, sales engineer of the Carboloy Company, should, however, be observed.

Be sure that the cutting speed is high enough. Too low a cutting speed will shorten the tool life and give an unsatisfactory finish on the work. The right cutting speed will produce a bright, smooth finish and prolong the tool life.

For turning, boring, and facing with ordinary single-point tools on various grades of steel, the cutting speed will depend upon the depth of cut, feed, and hardness of the metal to be cut. The usual range is from 200 to 350 surface feet per minute. Sometimes the character of the work necessitates the use of high-speed steel tools for some operations. The speeds of the spindles equipped with these tools may govern the speed of turning, facing, boring, etc., with carbide tools. In that case, the speeds for the carbide tools are likely to be too low.

Too fine a feed on rough-turning operations increases wear of the tool tip and makes chip disposal more difficult. Heavier feeds produce stiffer chips, which break more readily and can be handled more easily. When fine feeds are necessary, a carbide grade that has a high degree of wear resistance is recommended. Obviously, the choice of feed depends upon the type of tool used, the rigidity of the work, and the character of the steel being machined. Feeds from 0.010 to 0.020 inch per revolution are commonly used for single-point or roller turner tools.

Form tools require fine feeds to prevent chatter. Feeds from 0.0025 to 0.005 inch per revolution are generally used, but on some steels feeds up to 0.010 inch are possible. A harder grade of carbide is generally used for form tools to resist the abrasion caused by fine feeds.

Motors of greater horsepower may be required when an automatic screw machine is retooled for carbide tools, because of the increased speeds and the greater amount of metal removed per minute. To utilize existing equipment, however, the feed may have to be decreased and a harder grade of carbide used. The depth of cut can also be reduced, but the speed should not be cut below the minimum for carbide tools.

A cutting-off tool which feeds from the outside toward the center may start cutting at the proper speed, but obviously, the cutting speed will be reduced as the center is approached. On work where holes are drilled in the center, so that the tool does not have to cut to a dead center, little trouble is likely to be experienced; but when such operations are performed on solid steel parts with carbide tools, a built-up edge is frequently formed on the edge of the tool, causing dulling and flaking of the cutting edge. In some instances, it has been found possible to start a cut with a carbide cut-off tool and complete it with a high-speed steel tool.

The weight and the length of the piece being cut off must also be considered, as the "drop" may tend to cramp the tool and break the tip. If the piece being cut off has a hole in the center, a supporting bar may be fed into the hole to prevent the drop. If the work-piece has no hole, a V-guide can be fed under the work to support it and prevent cramping, or a guide with a hole fitting the outside of the work can be used to steady the overhanging piece.

For most types of steel cut in automatic screw machines, the rake angle of the carbide tool in the direction of the feed should be between 4 and 8 degrees on the chip-breaker surface. Rake angles up to 10 and even 15 degrees on the chip-breaker surface may be necessary when certain types of low-carbon, nickel-alloy, Nitralloy, stainless, and high-speed steels are to be cut.

Careful grinding of chip-breakers on carbide tools controls the dangerous ribbon chips which tend to wind around the tool-block and work. Chip curlers should be ground at an angle that will deflect the chip and cause it to clear the tool-holder or block. A chip-breaker should be ground at an angle to the side cutting edge to deflect the chip against the upturned shoulder of the work and thus break it.

The high cutting speeds used with carbide tools make the cooling quality of the cutting fluid an important item. Straight cutting oils are not usually recommended. Soft-soap base solubles help prevent rust, in addition to satisfactorily cooling the work. An ample flow of coolant is necessary. The cutting fluid should be supplied through pipes at least 3/8 inch in diameter, and the tank should be large enough to keep the coolant temperature reasonably low.

If there is any noticeable chatter, look for the following causes: Too light a tool section; too fine a feed; too large a nose radius; improperly ground tool; excessive tool overhang; a dull tool; or unsatisfactory support of the work.

# Editorial Comment

If there is not to be an interval of serious unemployment in the machine-building and metal-working industries at the time that war contracts are cancelled on a large scale, it is necessary that manufacturing concerns be permitted gradually to prepare for peacetime production. In many of the industries, this means that extensive tooling programs must be inaugurated and that manufacturers be permitted to execute such tooling programs and engage tool-manufacturing concerns to build tools and to obtain the materials required.

To reconvert to peacetime production may not take quite so long as it did to convert to the manufacture of entirely new products for war use; but the equipping for peacetime production, of shops that have been completely dismantled, cannot be done overnight. Take the automobile industry as an example. When the production lines are again arranged for efficient output, many new machine tools will be required. It would be well for the Government to permit and encourage the automobile manufacturers to order these machines now and to give the machine tool manufacturers who are not now occupied to capacity on machine tools for war equipment an opportunity to devote some of their energies to the development of the required equipment. There has been much talk about this, but full freedom of action has not been allowed.

***Retooling for Peace-Time Manufacturing Should Begin Now***

If this is not done, there will be a period when the war workers in automobile plants will be idle until the plants are ready to go ahead with peacetime production. There will, of course, always have to be a brief interval in swinging from one type of work to the other; but the length of this period depends largely upon the policy and attitude of the Government. The War Production Board has been giving serious consideration to this subject.

★ ★

[4] The general public, as well as business and industry, expects that when the war is over governmental controls that have been established for the purpose of intensifying the war effort and for preventing inflation will be almost immediately removed. However, it may be necessary to continue some of these controls for a certain period after the war if dangerous increases in prices, such as occurred after the last war, and serious upsets in business conditions are to be avoided. Hence, some of the present controls over prices, wages, and materials may have to be continued temporarily; but it is necessary that the temporary character of these controls be thoroughly clarified.

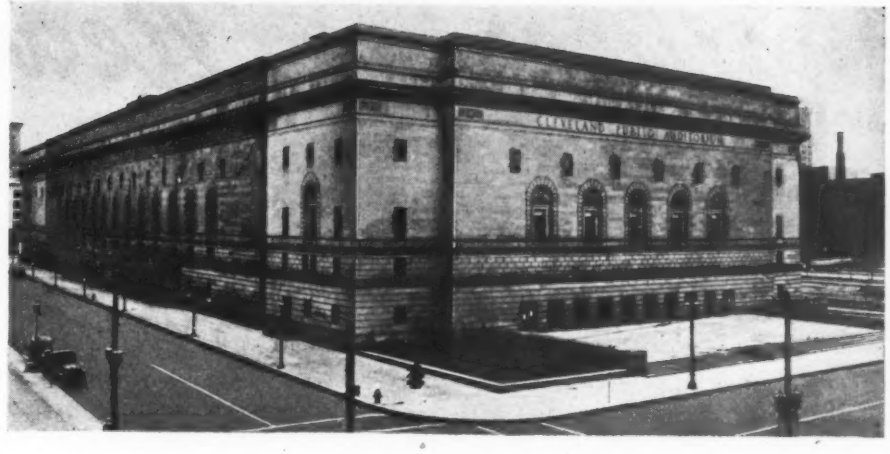
***Wartime Business Controls Must Not Become Permanent***

The danger that must be avoided is the creation of fear on the part of both the general public and business of permanent regimentation, since this would seriously hamper our free enterprise system. The Government should announce as promptly as possible the adoption of a definite policy with regard to post-war conditions, so as to convince business, industry, and the public that the Government has no intention of making the war controls permanent.

This is necessary in order that capital may flow freely into the enterpises, new and old, that, under a free economic system, will create employment and maintain normal business conditions when the war is over. The policies of the last few years that have been distinctly discouraging to private enterprise must be discontinued, and those who are able to build up industry and create employment must be encouraged to go ahead.

The freedom of business to expand and the employment that follows are necessary to maintain the prosperity and high standard of living that the resources of this nation are amply able to sustain. Such a standard of living cannot be created by economic theories, but must be founded on business confidence, enterprise, courage, and hard work. The cornerstone of this structure is business confidence, and nothing can build confidence more securely than a clear-cut pronouncement by those in high governmental authority as to the policies with regard to Government controls to be in effect after the war.

***Industry Should Be Assured of a Fair Chance***



# *The Twenty-Sixth Annual National Metal Congress*

**CLEVELAND, OCTOBER 16-20**

THE twenty-sixth annual National Metal Congress and War Conference Displays, to be held in the Public Hall, Cleveland, Ohio, October 16 to 20, promises to be one of the largest engineering meetings of the year. A great many manufacturers in numerous branches of the metal industries have signified their intention of exhibiting recent developments in the War Conference Displays.

The Metal Congress is sponsored by the American Society for Metals, in cooperation with the American Welding Society, the Iron and Steel and Metals Divisions of the American Institute of Mining and Metallurgical Engineers, the American Industrial X-Ray and Radium Society, and the Society for Experimental Stress Analysis.

In addition to the large number of papers that will be read before the various sessions of the American Society for Metals, there will be a series of twenty-one panel meetings, headed by panels of from three to ten leading authorities in specific branches of the metal industry. These meetings will cover new developments, especially those that have taken place during the war.

Among the subjects to be dealt with in these panels and in the papers read before the Society for Metals are: Metal powders and products; metals for railroads; metallurgical furnaces; induction heating; heat-treatment; manufacture of quality steels; National Emergency steels; surface peening; foundry metallurgy; quality control by statistical methods; salt baths; sub-zero treatments; surface finishes and protection; new developments in the study of corrosion; application and use of quality control instruments; tin and tin alloys; aluminum; magnesium; metal cutting and tool materials; and tools for inspection.

All the sessions will be held in the Public Hall, where the War Conference Displays will also be on exhibit. More than 325 manufacturers and state and civic organizations are planning exhibits that range through the whole list of ferrous and non-ferrous metals to processes and equipment for their production, fabrication, treatment, handling, and use. In all, 168,000 square feet of space has been reserved.

During the meeting, the American Society for Metals will receive the Ordnance Distinguished Service Award in recognition of its contribution to the war effort. This award, a scroll bearing the traditional seal of the Ordnance Department, will be presented at the annual dinner of the Society, Thursday evening, October 19, at the Hotel Statler.

The American Welding Society, which holds its twenty-fifth annual meeting in conjunction with the Metal Congress in Cleveland, will present an extensive program covering welding and allied subjects. The sessions of the American Welding Society will be held at the Hotel Cleveland. More than sixty papers will be presented at the seventeen technical sessions scheduled. These papers will cover the entire range of the application of welding and allied processes, emphasizing wartime applications.

# Engineering News

## Polarized Light Shows Way to Strengthen Nuts and Bolts

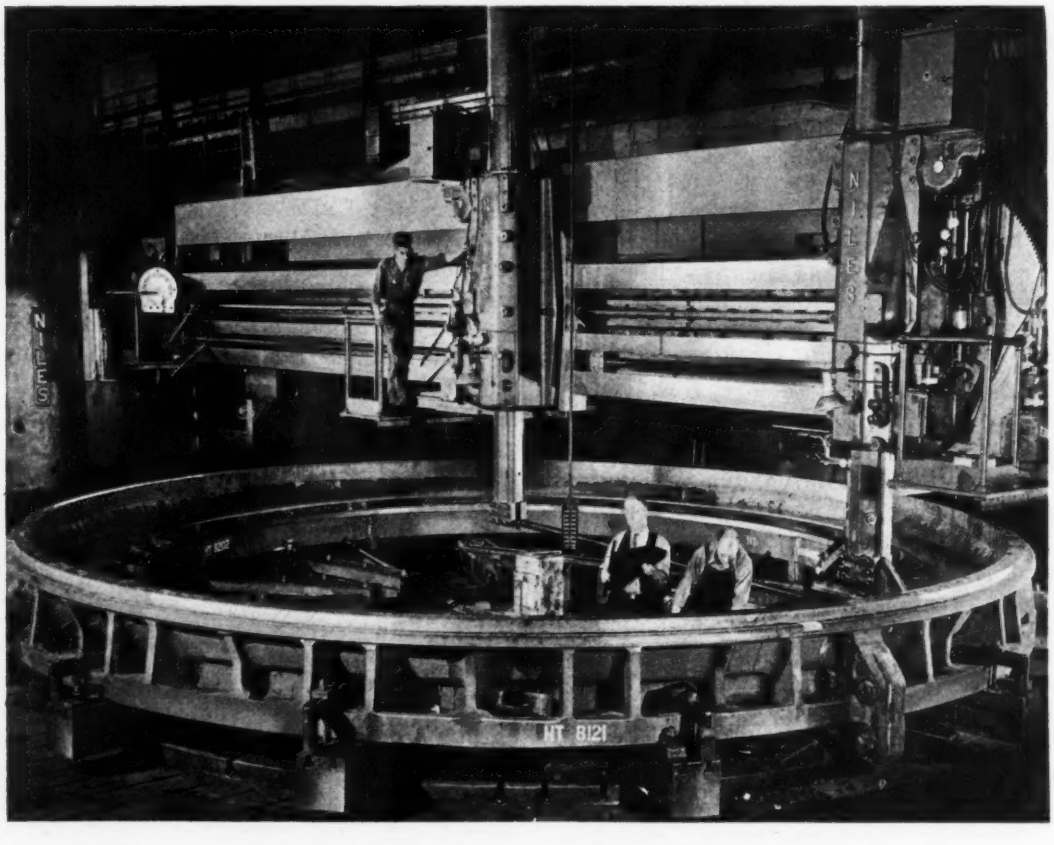
Nuts and bolts in steam turbines and other machines subjected to heavy duty can be made 40 per cent stronger by giving them broad shoulders and tapered bodies, according to Dr. Miklos Hetenyi, of the Westinghouse Research Laboratories. The new tapered design distributes the stress more evenly on the threads. With ordinary types of bolts the bottom thread carries most of the load.

In developing this design, it is interesting to note that polarized light was made use of to study the effects of stresses in nuts and bolts. Plastic models, 5 inches long, were made to represent 5-foot, 500-pound turbine bolts, which are sometimes subjected to million-pound pressures as the machine gets hot and expands. To simulate this strain, 30-pound weights were suspended from the bottom of the models, and the transparent plastic bolts were allowed to remain at a temperature of 250 degrees F. for three hours in order to solidify the stresses produced by the weights.

After cooling, slices were cut 1/8 inch from the center of each model and placed in a polariscope, which passed polarized light through the plastic sections and took pictures of the stress lines which had been baked in by the heat. The polarized light revealed rainbow-like lines which showed where the strain was distributed in the models. By studying polarized-light pictures of variously designed nuts and bolts, the new design was evolved.

## Thy-mo-trol Drive Reduces Machining Time from Hours to Minutes

The machining time for aluminum spar beams for plane wings has been reduced from several hours to a comparatively few minutes at a Cleveland aircraft plant through the application of the General Electric Thy-mo-trol, an electronic control applicable to machine tool opera-




Machining a Huge Metal Ring—the Base for a Large Gun Mount—in a Giant Boring Mill at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. This Ring, which is Shipped in Four Sections, Weighs, Complete, 92 Tons

tion. This electronic unit is installed on a large Onsrud automatic contour milling machine. The carriage of the milling machine houses four motor-driven cutter-heads, providing two horizontal and two vertical cutter drives with a speed range of from 3600 to 10,800 R.P.M. Each cutter is controlled by a follower, which travels over a templet or former bar as the carriage moves from one end of the table to the other. The four cutters take all the cuts that are necessary to completely finish the spar beam.

Through the Thy-mo-trol electronic control, the cutters are fed to the work at all times in proper relation to the changing contours of the spar beam. In one pass over the table, the depth of cut may be increased and decreased several times. Sometimes one cutter only may be at work—sometimes all four cutters are operating simultaneously. Such varying conditions require a change of feed to avoid overloading the cutter motors. Moreover, a fast "skip" feed is essential to save time when the cutters are running idle.

By means of the electronic control, carriage feeds of from 4 inches to 18 feet 6 inches per minute are possible.

Spinning the Protecting Wire under High Tension onto a High-pressure Cylinder

## Protecting Iron and Steel Against Heat Oxidation

Three processes applied to iron and steel to prevent corrosion at high temperatures are described in a folder recently published by the Metallizing Engineering Co., Inc., 38-14 Thirtieth St., Long Island City 1, N. Y. Known as "Metcolizing," these processes are said to increase the service life of ordinary iron and steel heat-treating equipment as much as from two to eight times.

One of the processes guards against the corrosive action of gases at temperatures up to 1600 degrees F.; another process is necessary when temperatures range from 1600 to 1800 degrees F.; while the third process is intended for conditions where the temperatures encountered are 1800 degrees F. and higher. These methods of protection against oxidation have been applied to structural furnace parts, burner caps, pyrometer tubes and brackets, annealing trays, carburizing boxes, melting pots, and exhaust manifolds.

## Wire-Wrapping Oxygen and Carbon-Dioxide Cylinders

A new method of preventing the bursting of oxygen and carbon-dioxide cylinders used for breathing and fire-fighting purposes on board planes has been developed by the engineers of Walter Kidde & Co., New York City. Untreated cylinders can explode into pieces flying like shrapnel when hit by flak or enemy machine gun bullets. The new process consists of wrapping each cylinder tightly with high tensile-strength steel wire. In cylinders so treated, a bullet will leave a clean hole with no fragmentation. In wrapping, the cylinder is spun at high speed and the wire is fed on it under high tension, the same as thread is wound on a spool. The end of the wire is soldered in place.

## Ingenious Wrapping Machine Handles Eleven Sizes of Cartons

An automatic wrapping machine that will wrap eleven different sizes of cartons has recently been built by the Package Machinery Co., Springfield, Mass., for a well-known biscuit company. This machine will automatically wrap eleven sizes of cartons from the largest, which is 14 inches long, 8 inches wide, and 7 inches deep, to the smallest, which is 5 inches long, 1 1/2 inches wide, and 1/2 inch deep. Only a simple adjustment is necessary to change from one size to another. The electric eye is used for accurately registering the wrapper. Thirty to seventy packages per minute are turned out.

# Ingenious Mechanical Movements

**Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices**

## Geneva Motion Mechanism of Unique Design

By CHARLES F. SMITH

In designing a machine for the automatic stamping of consecutive numbers on the corners of envelopes, the writer found it necessary to develop some interesting mechanisms, including the Geneva dial motion shown in the accompanying illustrations. This unique mechanism performs its intermittent indexing movements at a uniform rotational speed instead of at the accelerating and decelerating speed of the harmonic motion characteristic of the Geneva mechanism of conventional design ordinarily employed for such purposes.

Referring to Fig. 1, the mechanism is driven by a pinion at *A* which meshes with gear *B*. Indexing of turret *C*, as required to bring the correct numbers into their respective stamping positions, is controlled by a separate mechanism (not shown) which actuates trip-rod *D*. When rod *D* is moved by the control mechanism to engage clutch *E*, shaft *F* makes one revolution, being driven by pinion *A* through intermediate gears *B*, *G*, and *H*.

The Geneva motion driving member *I* (also shown in Fig. 2) keyed to shaft *F* indexes the Geneva dial *J* one station, or one-sixth of a revolution. Dial *J*, being secured to a sleeve on which turret *C* is mounted, transmits the same indexing movement to the turret and gear *K*. During the indexing movement, cam *L* shifts

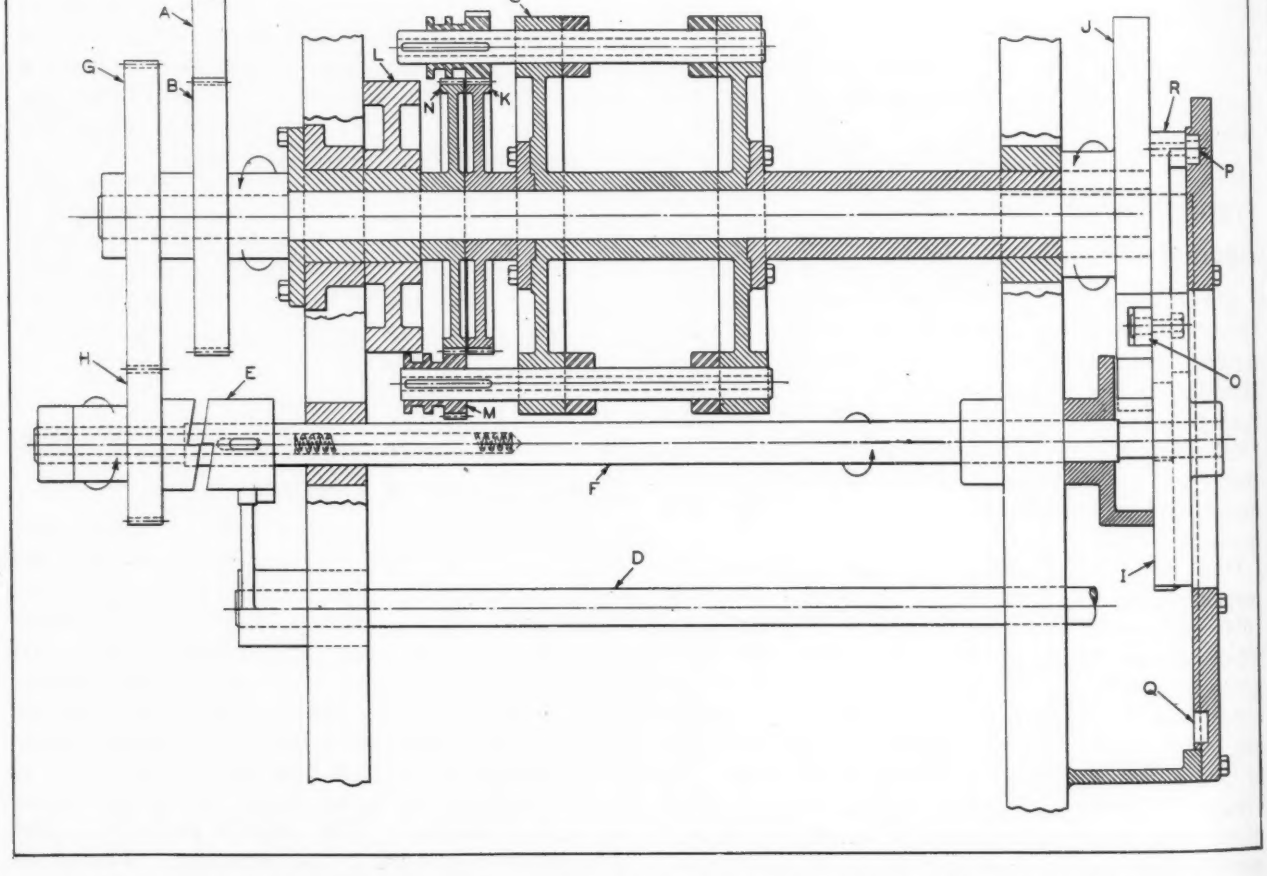



Fig. 1. Geneva Motion Mechanism of Special Design Developed to Obtain Uniform Indexing Speed

pinion *M* out of mesh with gear *N* and into mesh with gear *K*. In order to permit this gear shifting to be accomplished, it is necessary that gears *N* and *K* have the same constant rotational speed, which would not be the case if the Geneva motion mechanism were of conventional design. Thus it was necessary to modify the design of the Geneva drive motion, as indicated in the end view of the mechanism, Fig. 2.

Referring to Fig. 1, pin *O* (which in the case of a Geneva motion mechanism of the regular type would be in a fixed position) is secured in a slide *R* mounted in a dovetail groove in driver *I*. At the outer end of slide *R* is mounted a follower-roll *P*, which runs in a cam groove *Q* in a stationary plate. This cam groove is so designed that when pin *O* enters the driving groove or slot in the Geneva dial *J*, slide *R* is forced inward, causing pin *O* to accelerate the rotational speed of dial *J* sufficiently at the entering and leaving positions of the indexing movement to result in a constant or uniform rate of rotation for dial *J* during the entire indexing operation. This uniform speed of rotation, being the same as that of gear *K*, permits pinion *M* to be readily shifted from gear *N* to gear *K* or from *K* to *N* during the indexing movement of dial *J* through one-sixth of a revolution.

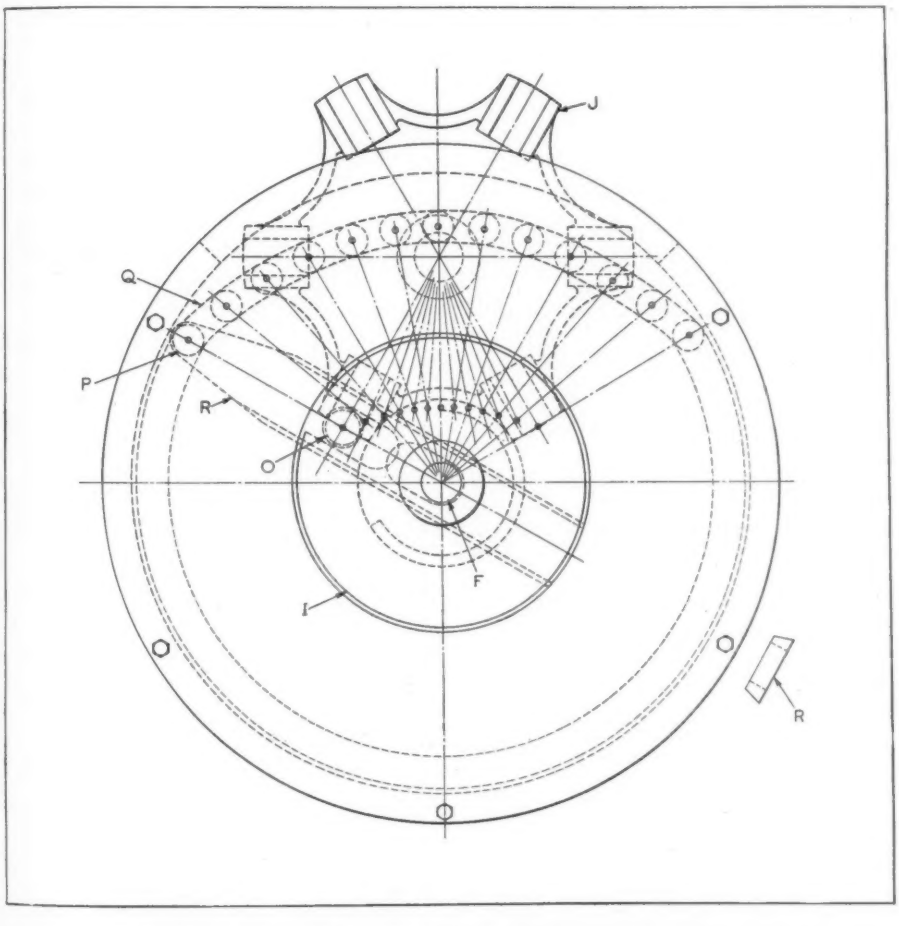



Fig. 2. End View of Geneva Motion Mechanism Shown in Fig. 1

## Mechanism for Producing Speed Change by Reversing Driving Shaft

By L. KASPER

The mechanism shown in the illustration on page 192 is employed on a machine for fabricating a twisted wire product. This machine twists a group of wires together, the pitch or degree of twist being controlled by the rate at which the wire is fed into the twisting mechanism. The wire is twisted in one direction for a specified number of turns at a given pitch, and then twisted in the reverse direction for a number of turns at a greater pitch.

To obtain the required twist, the twisting mechanism is reversed while the feeding mechanism continues in the same direction but at an increased speed. The mechanism illustrated simply provides for changing the speed of gear *D* when the driving shaft *A* is reversed without changing the direction in which *D* rotates.

Referring to Fig. 1, the shaft *A* rotates in the direction indicated by the arrow *V*. Gear *B*, which is keyed to shaft *A* and rotates with it, meshes with gear *C*. Gear *C* meshes with the internal gear *D*, which is a free running fit on shaft *A*, causing it to rotate in the direction indicated by arrow *X*. The pitch ratio between gears *B* and *D* of the mechanism, designed as illustrated, is 1 to 4, gear *C* acting as an idler while gear *B* drives gear *D*. Gear *D* is provided with sprocket teeth for the chain *H*, which transmits motion to the feeding mechanism at a distant point.

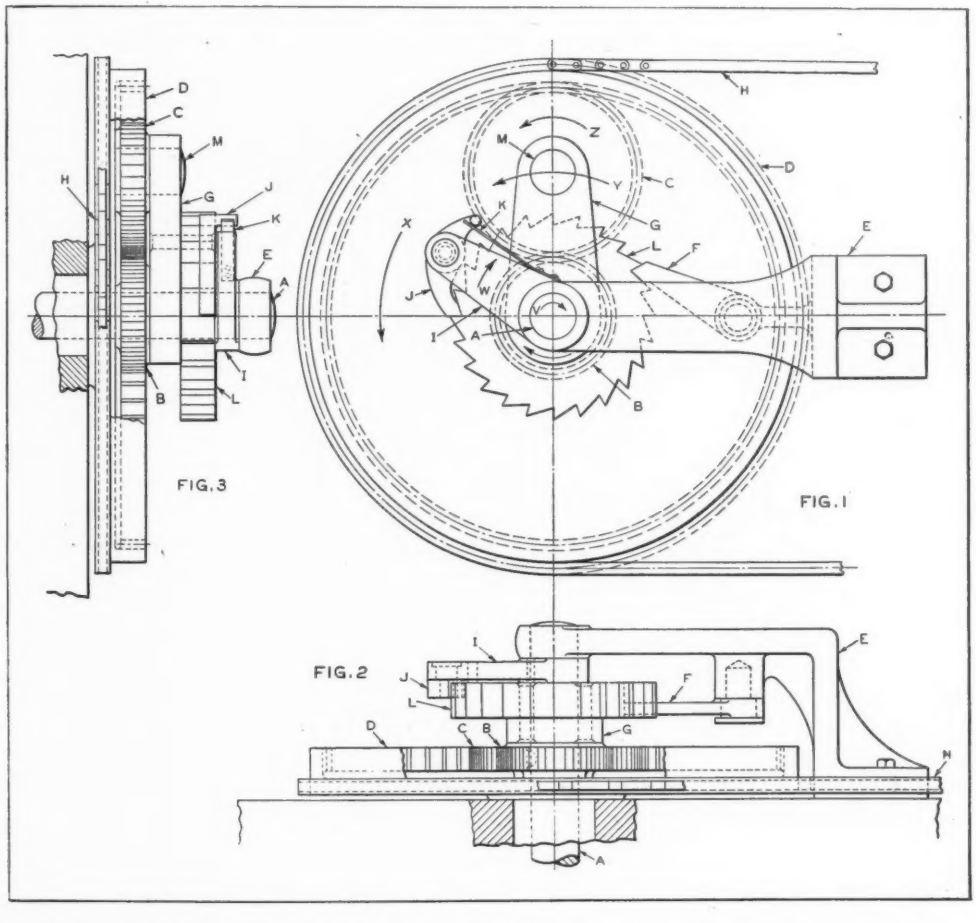
The lever *G* is free to turn on shaft *A*, and supports gear *C*, which rotates freely on stud *M*. Ratchet wheel *L* is also free to turn on shaft *A*, and is riveted to lever *G*. Lever *I* is keyed to shaft *A*, and carries the pawl *J*, which is held in contact with ratchet wheel *L* by the spring *K*. Bracket *E* supports the outer end of shaft *A*, which runs freely in its bearing. The pawl *F*, which engages ratchet wheel *L*, is also mounted on bracket *E*. As shaft *A* operates in a

horizontal position, no spring is required to keep pawl *F* in contact with the teeth of ratchet *L*. Figs. 1, 2, and 3 show the mechanism at the same point in the operating cycle.

In operation, shaft *A*, rotating in the direction indicated by arrow *V*, carries with it gear *B* and lever *I*. Gear *C*, meshing with gear *B*, rotates in the direction indicated by arrow *Z*, transmitting its motion to gear *D* in the direction indicated by arrow *X* at a reduced speed of rotation in the ratio of 4 to 1. Although lever *I* and pawl *J* rotate with shaft *A*, no motion is transmitted to ratchet wheel *L*, the teeth of which are designed for engagement with the pawl when rotating in the opposite direction. However, the rotation of gear *B*, acting on gear *C* at the point of contact, and the resistance of gear *D*, acting on gear *C* at the point of contact on the opposite side, produce a turning movement of lever *G* in a clockwise direction, opposite that indicated by arrow *Y*.

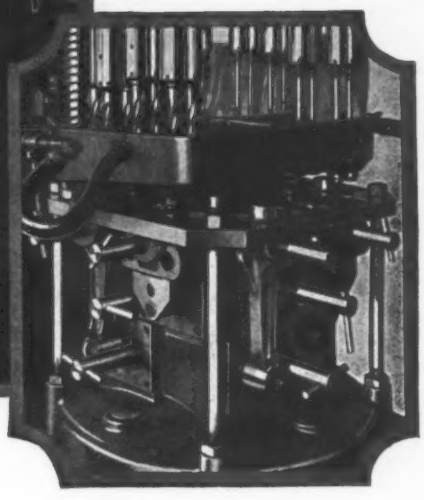
As lever *G* and ratchet wheel *L* are riveted together, any motion or reaction affecting one also affects the other. Hence, the reaction on lever *G* serves to maintain engagement of pawl *F* with ratchet wheel *L*, which prevents clockwise rotation of the ratchet wheel. Thus the axes of shaft *A* and stud *M* are maintained in fixed positions; the assembly acts as a simple gear train, the power being transmitted from gear *B* to gear *D* through idler *C* in the ratio of their pitch diameters.

When shaft *A*, Fig. 1, which operates the twisting mechanism, is rotated counterclockwise, or in the opposite direction to that indicated by arrow *V*, lever *I* also rotates in that direction, causing pawl *J* which rotates with it, to engage the teeth of ratchet wheel *L*, so that the ratchet wheel will be rotated in the same direction, the pawl *F* at this point becoming inactive. As ratchet wheel *L* and lever *G* act as a unit, ratchet wheel *L*, stud *M*, and gear *C* rotate in the direction of arrow *Y*, with the axis of shaft *A* serving as a center. As gears *B* and *C* are now rotating about the same axis, there can be no motion of gear *C* about the center of stud *M* as an axis. Therefore, gear *C* can no longer operate as a gear, but merely serves as a connecting link for transmitting motion from shaft *A* directly to gear *D*. In this manner, the chain *H* is given a uni-directional movement at two speeds, as controlled by the direction of rotation of shaft *A*, which operates at a uniform speed, but is periodically reversed.




**Mechanism Designed to Drive Sprocket D from Shaft A at a Ratio of 1 to 4 when Shaft A Rotates in Direction Indicated by Arrow V, and to Continue to Drive Sprocket D in Same Direction but at a Ratio of 1 to 1 when Shaft A is Reversed**

# Design of Tools and Fixtures



## Lathe Set-Up for Cutting Accurate Threads with Die-Head

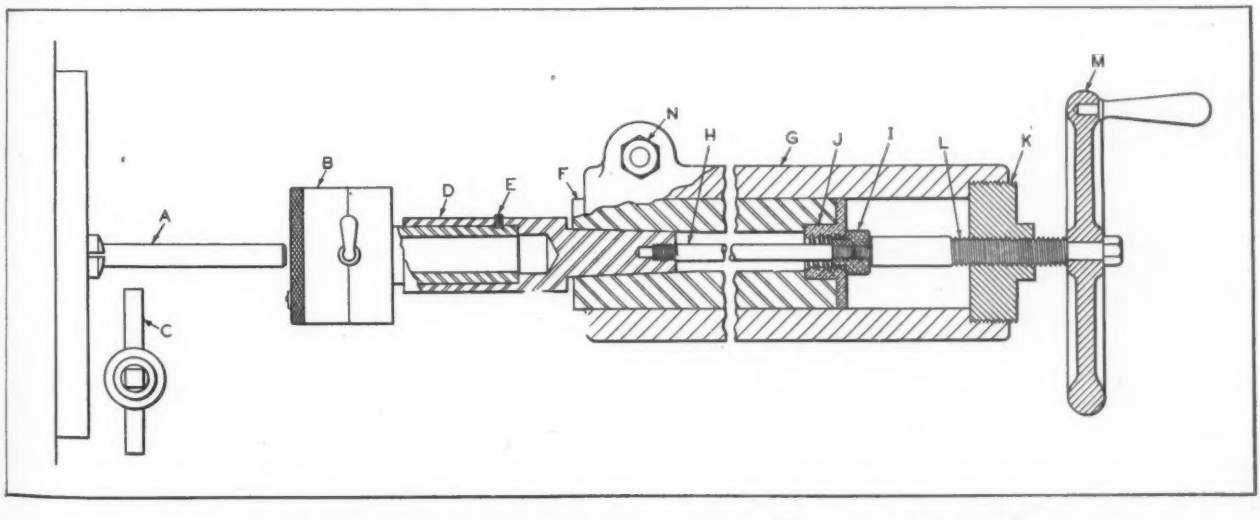
By R. BROWN, Engineer
Chicago Pneumatic Tool Co.
Oklahoma City, Okla.

The handling of contracts for products not ordinarily manufactured in our oil-field equipment repair shop has been greatly facilitated by applying several valuable ideas obtained from articles published in MACHINERY on tool design and methods of using available equipment. The method of setting up a lathe for threading operations shown in the accompanying illustration is one of the writer's own ideas, which may prove valuable to small shops having similar threading problems.

Some months ago, we received an order for approximately 5000 parts which necessitated cutting 5/8 by 18 N.F. Class 3 threads, 4 1/2 inches long, on the end of some rods. The only available machine for this job was an 18-inch Sidney lathe built about 1922. By using the set-up illustrated, we were able to cut these threads to a Class 3 fit at a good production rate.

Referring to the illustration, a rod on which the thread is to be cut is shown at *A*, while the radial type, self-opening die-head employed for the threading operation is shown at *B*. Stop *C*, consisting of a bar held in the toolpost, served to limit the thread cut to the predetermined length of 4 1/2 inches. Adapter *D* was made to fit snugly over the shank of the die-head and was threaded for a set-screw at *E*. A No. 3 shank was turned at the outer end of the adapter to fit the tailstock column. This shank was drilled and tapped to take the safety rod *H*.

The safety rod was threaded on both ends, and a nut *I* was made to fit on the outer end, the rod being of the proper length to pull the adapter shank tightly into the tailstock column. An-




Set-up Employed on Lathe for Cutting Accurate Threads with Die-head

other adapter *K* was made to fit in the outer end of the tailstock barrel in place of the regular thrust bearing. Screw *L* was made with a coarse thread to run in adapter *K*. The outer end of screw *L* was machined to fit handwheel *M*.

In disassembling the conventional tailstock and setting it up as shown for threading, it is first necessary to remove the tailstock screw thrust plug, slide the column out, put the die-head adapter *D* in place, insert safety rod *H* in the column, and tighten nut *I*. Adapter *K* is then screwed into place. Tailstock column *F* is next slid back into barrel *G*. The machine is then ready to perform the threading operation. Parts *B*, *D*, and *H* may be kept assembled as a unit. This applies also to parts *L*, *K*, and *M*. Stop *C* is carefully set for the proper length of thread, the die is closed, and the lathe started.

A few turns of the handwheel *M* serve to start the die on the work, after which the die-head pulls or feeds itself on the work. Clamping nut *N* is, of course, left loose so that the column can slide freely, there being no connection between nut *I* and screw *L*. Adapter *D* and the bore in this member can be made long enough to permit cutting any length of thread desired, within practical limits.

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## Dies for Forming Cylindrical Sleeves from Flat Metal Strips

Strip material 1/2 inch wide is cut off and formed into cylindrical bushings or sleeves ranging from 7/16 inch up to 3 inches in diameter in dies of the type shown in Figs. 2 and 3. The larger size sleeves are comparatively easy to produce, but those of smaller diameter (say below 1 inch) are more difficult to form, especially when the material is not annealed.

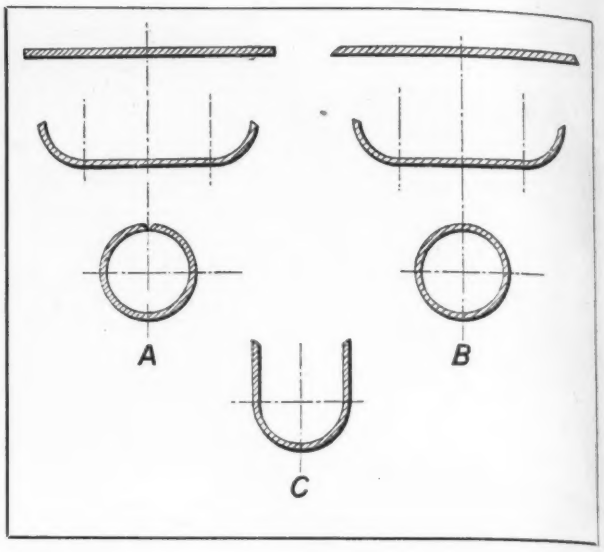


Fig. 1. Successive Steps in Forming Strip Material into Cylindrical Sleeves

At *A*, Fig. 1, is shown the simplest sequence of operations for forming the sleeves. It will be noted that when the strip is cut off square at the ends, the ultimate form, although truly cylindrical on the inner surface, has a V-shaped gap on the outside where the cut-off edges meet. When this gap is not objectionable, production is simplified to the extent that, after cutting the blank to length, only two sets of simple and quite inexpensive dies are required.

Should this weakness at the joint be detrimental to the work, the strips must be cut off in such a manner that a bevel is formed at each end of the blank as shown in the upper view at *B*, Fig. 1. The bevel-edged blank, after being

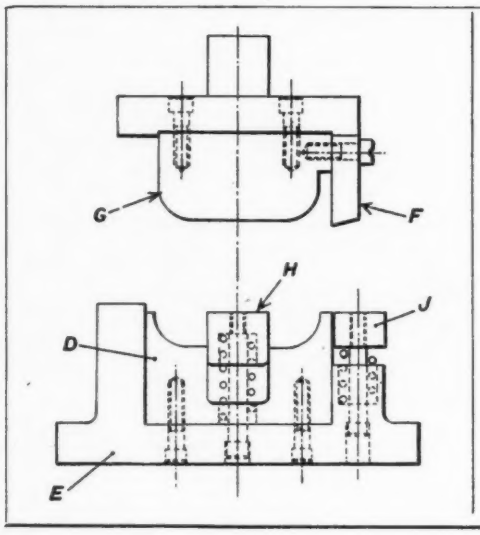


Fig. 2. Die Used for Shearing and First Bending Operation on Sleeve Shown at A, Fig. 1

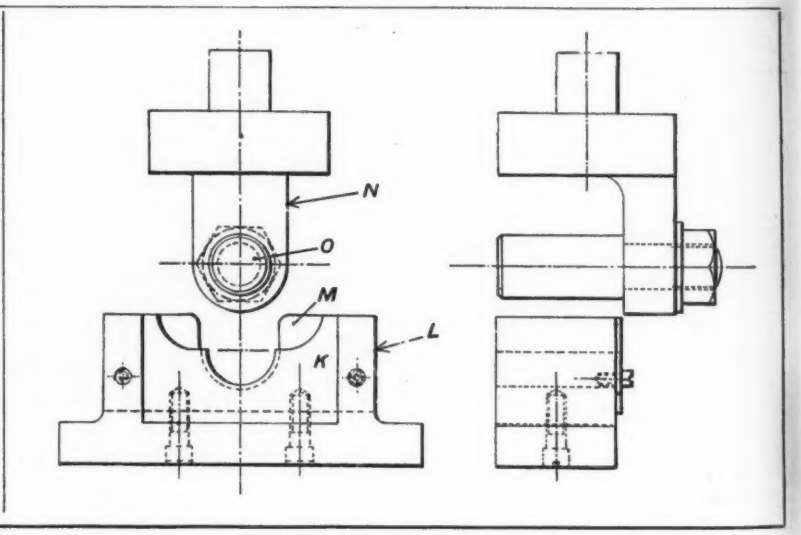


Fig. 3. Die for Second Bending Operation which Forms Sleeves Shown at A and B, Fig. 1, to Cylindrical Shape

formed, will be truly cylindrical, as shown by the lower view at *B*.

At *C* is shown an alternative design, in which the blank is first bent to a U-shape. This U-shaped piece is finally bent or formed over a mandrel, either in two separate operations or in one stroke by the use of a set of double-action dies.

The die for the first stage, shown in Fig. 2, provides for cutting the strip to length and forming a quarter-circle bend at each end. The cast-steel die *D*, machined and finished to the correct size and form, is retained in a mild-steel bolster *E* by set-screws. The die is hardened and ground at the right-hand top corner to form a cutting edge, along which the knife *F* on the punch will shear off the blank. The top forming punch *G* is shown attached to a punch-holder. A piece *H*, ground to a sliding fit in a channel machined across the die *D*, is held at a high level in the die by a spiral compression spring fitted into a pocket in the base. Piece *H* thus serves as a blank-holder while the shearing knife operates, and steadies the blank during the bending process.

A similar pad *J* at the right of the die further steadies the strip. A groove in pad *J* of the same width as the strip stock assists in feeding the work to the die. If the die is used on an inclined power press, the cut-off and bent-up pieces fall to the back of the machine, and the operation is continued without interruption.

The die shown in Fig. 3 is employed for the second and final bending operation, which brings the work to the required cylindrical form. The construction of this die is similar to that of the die shown in Fig. 2, the die member *K* being held in the mild-steel bolster *L*. A gage strip *M* at the back of the die assists in locating the bent pieces which, on the descent of the punch *N*, are forced down into the lower groove in the die, and curled over the mandrel portion *O* to a cylindrical form. There is sufficient spring in the material to allow the finished piece to be pushed off the mandrel by the succeeding piece.

The sleeves are sized accurately to commercial limits when necessary by pushing them through a swaging die, in which they are planished and properly formed between the accurately ground punch and die.

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## Staggered-Tooth Vertical Milling Cutter

By T. HAUG and R. SMITH
Philadelphia Maintenance and Repair Division
Westinghouse Electric & Mfg. Co.
Philadelphia, Pa.

Milling time has been reduced forty per cent, cutter life has been increased, and regrinding and sharpening of tools has been considerably speeded up by the development of a new milling cutter at the Philadelphia Maintenance and Repair Division of the Westinghouse Electric & Mfg. Co. A total of eight sintered carbide tools is mounted in an adapter, as shown in Fig. 1, to produce a staggered-tooth vertical milling cutter. The tools are not located equidistant from the center in the conventional manner but are mounted so that each successive tool or tooth is set 3/32 inch closer to the center than

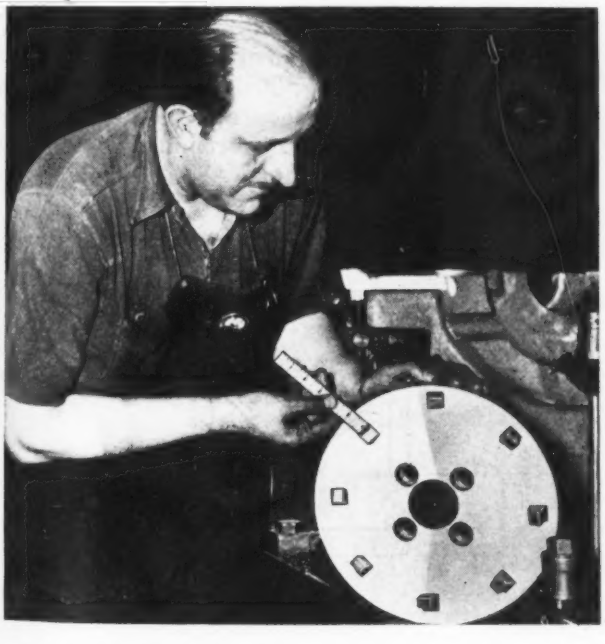


Fig. 1. Checking the Setting of Tools in Staggered-tooth Vertical Milling Cutter

Fig. 2. View Showing Cut Taken with the Staggered Cutter Illustrated in Fig. 1

the preceding one. The pronounced difference between the distance from the edge of the adapter to the tool which the operator is checking and the distance between the edge of the adapter to the next tool on the right can be readily seen by referring to the illustration.

The tools are also mounted in such a manner that each tooth projects outward 1/16 inch more than the preceding one. Hence, each tooth cuts in a different vertical plane as well as a different horizontal plane. Slots in the adapter have a 10-degree angle that gives the tool a negative rake.

It has been found that this cutter will remove eight times as much metal in a given time as the conventional cutter, taking up to a 1-inch cut, whereas the ordinary milling cutter could take only a maximum cut of 1/8 inch. The new cutter is used chiefly for roughing and semi-finishing work, the usual depth of cut being 1/2 inch. In this case, the eight separate teeth take only a 1/16-inch cut.

The individual cutters in this staggered-tooth vertical milling cutter are tipped and run at quite high speeds. For example, one set-up takes intermittent cuts 3/4 inch deep on cast steel at a speed of 80 R.P.M. with a 1 inch feed per minute. When the cutter requires sharpening, it is unnecessary to remove the entire cutter-head since the eight dull cutters can be removed and replaced with a sharp set. This change can be made in from 5 to 10 minutes. About 15 minutes is required to grind or sharpen the eight cutters, whereas the grinding of a typical milling cutter of the same size would require about 4 hours.

* * *

Because they are light in weight and non-corrosive, plastics are now being used for making emergency pumps for life rafts. In this pump construction, molded, extruded, and laminated plastics find employment.

## Dividing Fractional Dimensions in Half

On page 228 of August MACHINERY, an article was published entitled "Simple Method of Dividing Fractional Dimensions in Half." It has been called to our attention by L. Kasper, Philadelphia, Pa., that this method applies only when the whole number preceding the fraction is an odd number. Obviously, to divide a whole number and a fraction in half when the whole number is an even number is an easy matter anyhow, as one simply has to divide the whole number in two and make the denominator of the fraction double that of the original fraction, keeping the numerator the same; as, for example, half of 18 23/32 is, obviously, 9 23/64.

* * *

## Fabricated Design Saves Material and Labor

A saving of 37 per cent in material and labor in the production of certain guides for motor-generator sets at General Electric's Schenectady Works resulted from the suggestion of Ivan Wilday, a milling machine operator, that the part could be fabricated instead of machined.

While machining the part shown in Fig. 1, Mr. Wilday noticed that an extension of the lines *AO* and *BO* formed a right angle, and also that the distances *C* and *D* corresponded with the dimensions of a piece of standard 1/2- by 3- by 3-inch angle-iron. He suggested fabricating the part as shown in Fig. 2 by welding together a piece of angle-iron and three pieces of light bar stock.

The fabricated guide proved to be every bit as good as the guide previously made from heavy bar stock. Of course, accuracy in fabrication is essential, and the finished part must be annealed in order to relieve strains.

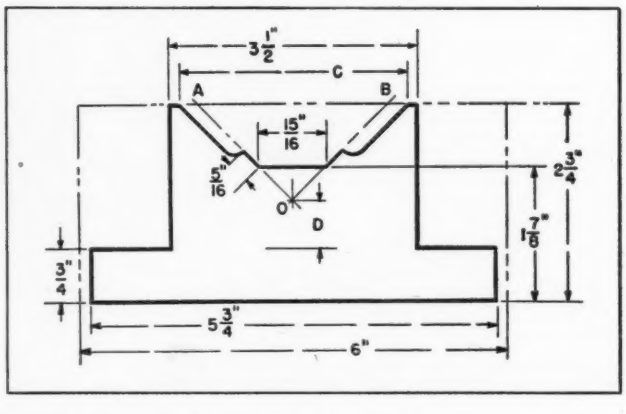



Fig. 1. End View of Guide for Motor-generator Milled from Bar Stock

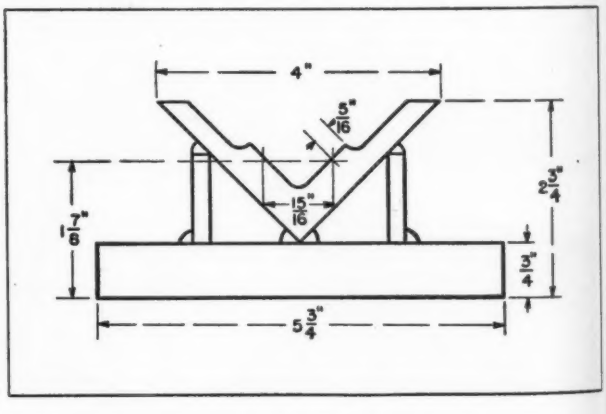



Fig. 2. Guide Made by Welding Angle-iron and Bar Stock together

## Westinghouse Demonstrates Tank-Gun Stabilizer

A gyroscopic tank-gun stabilizer which has proved a distinct asset to our Armed Forces was described and put through its paces at a recent demonstration at the Springfield, Mass., plant of the Westinghouse Electric & Mfg. Co. Clinton R. Hanna, the company's research engineer who invented and developed the device, briefly described its action.

A highly sensitive gyro-stabilizer holds the gun in its aimed position despite the pitching and rolling of the tank. Until this stabilizer was adopted, it was accepted military practice to have half of a group of tanks stop and fire and then advance while the other half stopped. Under this system, only half of the guns could fire at one time. This was true of all tanks in all the armies engaged in the war. It was necessary for the tanks to halt, because they could not fire accurately while in motion. Obviously, when they stopped they became an excellent target for the enemy's batteries. Now when one of these stabilizers, actuated by a gyroscope small enough to be held in the hand, is attached to a tank gun, it holds the gun in position on the target, even though the tank itself is plunging over fox holes or shell holes, or climbing hills.

The work on this stabilizer began in 1939 in the Westinghouse research laboratories at East Pittsburgh, Pa. The device was adopted and first put in use by the Army in 1942. It is now part of every tank shipped overseas. According to General L. H. Campbell, Jr., Chief of Ordnance, the gyro-stabilizer increases the accuracy of tank guns several hundred per cent. It is one of the more important contributions to the war effort.

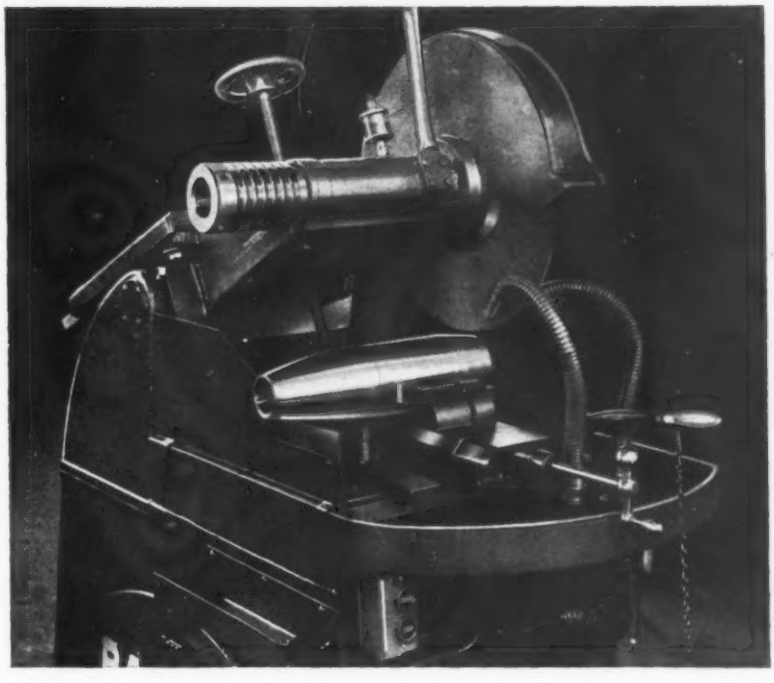
* * *

### Reconditioning Files

Files are customarily discarded when old or worn. Recently, however, a wartime saving method has been developed by the Sav-A-Tool Corporation, 3573 Eastern Ave., Cincinnati 26, Ohio, which is said to greatly prolong the usefulness of files and, in addition, to save steel urgently needed for war work. It is stated that the method does not affect the original temper of the file treated. Files to be restored are sent to the Sav-A-Tool Corporation, the reconditioning work being done in its own plant.

## Cutting off Ends of Shells with Abrasive Wheels

It requires only from seven to eight seconds cutting time to cut off the end of a 105-millimeter shell with an abrasive wheel in the Radiac abrasive cut-off machine shown in the illustration. This machine is made by A. P. de Sanno & Son, Inc., Phoenixville, Pa. A Radiac synthetic rubber bonded disk, 18 inches in diameter and 3/32 inch thick, is used. Following the cutting-off operation, the end of the shell is faced.



Cutting off the End of Shell in a Radiac Abrasive Cut-off Machine

The vise in which the shell is held supports it at both ends. In order to expedite handling, a foot-treadle is provided for opening and closing the jaws of the vise.

* * *

### Oil Filtration for Gasoline and Diesel Engines

A new line of self-contained automatic recirculating clarifiers, known as the DRU series, especially intended for the lubrication systems of Diesel, gasoline, and natural gas engines, where operating temperatures are too low or pump capacities are inadequate for maximum filtration efficiency, has been brought out by the Briggs Clarifier Co., 1339 Wisconsin Ave., N.W., Washington 7, D. C. This equipment is a completely self-contained unit with electrically operated pumps and heaters which act independently of the engine or lubricating system.

# New Trade Literature

## RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

*To Obtain Copies, Fill in on Form at Bottom of Page 199 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October Number of MACHINERY*

### Fleet-Welding

LINCOLN ELECTRIC CO., Cleveland 1, Ohio. Bulletin containing technical information on "Fleet-Welding" (a method for increasing the speed of welding of mild steel), prepared to assist users of arc welding in establishing proper welding procedures and control. ..... 1

### Precision Instruments

GEORGE SCHERR CO., 199 Lafayette St., New York 12, N. Y., has resumed regular publication of its house organ "Precise Production." The current issue (No. 105) introduces the Scherr Opti-Flat, a new glass surface plate that is accurate within fifty millionths inch. ..... 2

### Optical Pyrometers

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia 44, Pa. Catalogue N-33D, descriptive of an optical pyrometer of the potentiometer type—a portable instrument for measuring the temperatures of glowing objects with laboratory precision. ..... 3

### Abrasive Strip for Inaccessible Parts

MINNESOTA MINING & MFG. CO., St. Paul 6, Minn. Booklet entitled "Knocking the 'In' Out of Inaccessible," showing several examples of the use of Elek-Tro-Cut Three-M-ite cloth for finishing parts that are difficult to reach. ..... 4

### Use and Care of Micrometers

SAV-WAY INDUSTRIES, Box 117, Harper Station, Detroit 13, Mich. Booklet on the use and care of micrometers, including a description of Sav-Way master setting and checking rolls for micrometers and other precision measuring instruments. ..... 5

### Attachments for Rotary Shears

QUICKWORK DIVISION OF WHITING CORPORATION, 15673 Lathrop Ave., Harvey, Ill. Bulletin QW-120 featuring the applications and operation of circle-cutting, flanging, and other attachments used on Quickwork rotary shears. ..... 6

### Cold-Rolled and Cold-Drawn Steels

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York 17, N. Y. Circular CR100, containing data on cold-rolled and cold-drawn specialty steels. Bulletin CR102, listing sizes and weights of carbon tool-steel drill rod. ..... 7

### Steel

TIMKEN ROLLER BEARING CO., STEEL AND TUBE DIVISION, Canton 6, Ohio. 78-page book, 8 1/2 by 11 inches, entitled "Evaluating the Forgeability of Steels," containing recommended forging temperatures for sixty-eight types of steel. ..... 8

### Analysis of Tapping Troubles

HENRY P. BOGGIS & CO., 1279 W. 3rd St., Cleveland 13, Ohio. Shop Reference List No. 15 entitled "Quick Analysis of Tapping Troubles," containing a check list for such troubles, together with suggested remedies. ..... 9

### Work-Tables

VOSS MACHINERY CO., 2804C W. Liberty Ave., Pittsburgh 16, Pa. Leaflet on Rightop work-tables and holding racks, embodying an ingenious idea suitable for experimental work, assembly work, model-making, laboratory work, etc. ..... 10

### Shot-Peening and Fatigue of Metals

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Booklet entitled, "Shot-Peening and the Fatigue of Metals," containing research data on this subject never before published. 11

### Gear-Finishing Machines

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich. Bulletin 860A44, descriptive of the line of Michigan Model 860-A crossed-axis gear-shaving machines for spur and helical gears. ..... 12

### Quick-Acting Clamping Units

MECHANICS ENGINEERING CO., Jackson, Mich. Leaflet descriptive of "Bar-Lok" quick-acting pressure units designed for rapidly clamping and unclamping work in jigs and fixtures. ..... 13

### Centrifugal Filters and Sump Tank Cleaners

W. R. CARNES CO., 2066 Helena St., Madison 4, Wis. Bulletin M24, on combination sump tank cleaning machine and centrifugal filter; also bulletin on sump tank cleaning. 14

### Tools with Eccentric Drives

MORELAND TOOL CO., 16935 W. McNichols Road, Detroit, Mich. Catalogue containing illustrations and specifications covering a new counterbore and special high-speed steel cutting tools with eccentric drives. ..... 15

### Automatic Oilers

TRICO FUSE MFG. CO., 2948 N. 5th St., Milwaukee 12, Wis. Bulletin 28-A, illustrating and describing automatic oilers with plastic reinforced reservoir for solid, wick, and waste-packed bearings. ....16

### Grinding with Oil

D. A. STUART OIL CO., LTD., 2739 S. Troy St., Chicago 23, Ill. Booklet entitled "Grinding with Oil," containing information on the selection of the proper oil for precision grinding operations. ....17

### Super-Speed Piercing

WIEDEMANN MACHINE CO., 1807 Sedgley Ave., Philadelphia 32, Pa. Bulletin descriptive of the Wiedemann Type R-44 turret punch press for super-speed piercing of sheet metal through templets. ....18

### Elastic Stop-Nuts

ELASTIC STOP NUT CORPORATION OF AMERICA, 1060 Broad Street, Newark 2, N. J. Catalogue and data book (119 pages, 9 by 12 inches) on self-locking nuts, for designers, purchasing men, and users. ....19

### Pull-Up Broaching Machines

COLONIAL BROACH CO., P. O. Box 37, Harper Station, Detroit 13, Mich. Bulletin VDS-44, illustrating and describing Colonial Model VDS pull-up broaching machines, tools, and attachments. ....20

### Oil-Power Fluid Motors

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin 113, illustrating and describing Sundstrand oil-power fluid motors for converting oil under pressure to rotary motion. ....21

### Marking Devices

MARQUETTE ENGRAVING & MFG. CO., 3421 Lincoln Ave., Chicago 13, Ill. Folder illustrating and describing this company's line of steel stamps, dies, and other marking devices. ....22

### Quenching Equipment

BELL & GOSSETT CO., Morton Grove, Ill. Catalogue JC-744, illustrating and describing the B & G Junior Quencher for controlled quenching where small pieces are heat-treated. ....23

### Threaded Insert and Stud Locking System

BARDWELL & MCALISTER, INC., Box 1310, Hollywood 28, Calif. Catalogue containing the latest data on the Rosan locking system for threaded inserts and studs. ....24

### Plastic Shims for Roller Bearings

INDUSTRIAL PRODUCTS SUPPLIERS, 2 Broadway, New York 4, N. Y. Folder descriptive of Artus plastic shims for adjusting Timken roller bearings. ....25

### Milling Machines

W. H. NICHOLS & SONS, Waltham, Mass. Bulletin entitled "The Miller that Uses its Head," showing examples of these machines in actual operation on a wide variety of work. ....26

### Worm-Gear Speed Reducers

PHILADELPHIA GEAR WORKS, INC., Erie Ave. and G St., Philadelphia 34, Pa. Bulletin 250, giving capacities and horsepower ratings of "AirKooled" worm-gear speed reducers. ....27

### Combination Electric Hammer and Drill

WODACK ELECTRIC TOOL CORPORATION, 4627 W. Huron St., Chicago, Ill. Bulletin 442, describing the Wodack "Do-All" combination portable electric hammer and drill. ....28

### Spiral Fluted Reamers and Carbide-Tipped Tools

CHICAGO-LATROBE TWIST DRILL WORKS, 411 W. Ontario St., Chicago 10, Ill. Circulars on high-speed spiral-fluted chucking reamers and carbide-tipped reamers. ....29

### Pneumatic Comparators

MOORE PRODUCTS CO., H and Lycoming Sts., Philadelphia 24, Pa. Bulletin 801-S, containing instructions on the installation, operation, and maintenance of Moore pneumatic comparator gages. ....30

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### Carbide Tools

TUNGSTEN ALLOY MFG. CO., 65 Colden St., Newark 4, N. J. Catalogue T44, covering Tamaloy carbide-tipped cutting tools, tool blanks, and lathe and grinder centers. ..... 31

### Surface Plates and Straightedges

BARCO SCRAPING CO., 1975 E. 65th St., Cleveland 3, Ohio. Bulletin on surface plates, angle-irons, and straightedges made from Meehanite. ..... 32

### Grease Lubrication

SUN OIL CO., 1608 Walnut St., Philadelphia 3, Pa. Booklet entitled "What Makes a Grease?"—one of a series in a "Save and Serve with Proper Lubrication" campaign. 33

### Vertical Steel Plate Punches

THOMAS MACHINE MFG. CO., Pittsburgh 23, Pa. Bulletin 303, entitled "Vertical Punches," describing punches with welded as well as cast frames. ..... 34

### Flat Spray Nozzles

CHAIN BELT CO., Milwaukee, Wis. Bulletin 459, descriptive of Rex flat spray nozzles for washing, cleaning, cooling, and descaling. 35

### Rotary Files

GROBET FILE CO. OF AMERICA, 421 Canal St., New York 13, N. Y. Folder "Rotary Files War Supplement," describing over seventy-two rotary files. ..... 36

### Milling Cutters

EKSTROM, CARLSON & CO., Rockford, Ill. Catalogue 43, covering the Ekstrom-Carlson line of router bits and form cutters for cutting intricate blanks and shapes. ..... 37

### Clamping Dogs

QUIK CLAMP MFG. CO., 6017 Nina Ave., Chicago 31, Ill. Leaflet illustrating and describing the "Quik Clamp" dog for work that is machined or ground between centers. ..... 38

### Metallizing Equipment

METALLIZING CO. OF AMERICA, 1330 W. Congress St., Chicago 7, Ill. Catalogue covering Mogul metallizing equipment, including price list. ..... 39

### Universal Tool Grinders and Fixtures

K. O. LEE CO., Aberdeen, S. D. Bulletins descriptive of "Knock-Out" universal tool grinders and fixtures, and their use. ..... 40

### Data on Steel Selection

LA SALLE STEEL CO., P. O. Box 5800-A, Chicago 80, Ill. "Steel Bar Planning Guide," for use in selecting the proper cold-finished and furnace-treated bar steels. ..... 41

### Universal Joints

GEAR GRINDING MACHINE CO., Detroit 11, Mich. Booklet describing the design and method of operation of Rzeppa constant-velocity universal joints. ..... 42

### Fractional-Horsepower V-Belt Drives

B. F. GOODRICH CO., Akron, Ohio. 44-page handbook on fractional-horsepower V-belt drives. ..... 43

### Tap Reconditioners

DETROIT TAP & TOOL CO., 8432 Butler Ave., Detroit 11, Mich. Bulletin DTR-3, covering the Detroit tap reconditioner. ..... 44

### Engine Lathes

SOUTH BEND LATHE WORKS, South Bend 22, Ind. Catalogue 100-C, covering the South Bend line of precision lathes. ..... 45

### Cast-to-Shape Steels

JESSOP STEEL CO., Washington, Pa. Catalogue descriptive of Jessop cast-to-shape tool steels. ..... 46

### Air-Operated Controllers

BRISTOL CO., Waterbury 91, Conn. Bulletin A115, describing a new line of air-operated controllers. 47

### Retaining Rings

NATIONAL LOCK WASHER CO., Newark, N. J. Bulletin on heat-treated spring steel rings. ..... 48

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**Which of the new or improved equipment described on pages 202-230 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in October, 1944, MACHINERY.**

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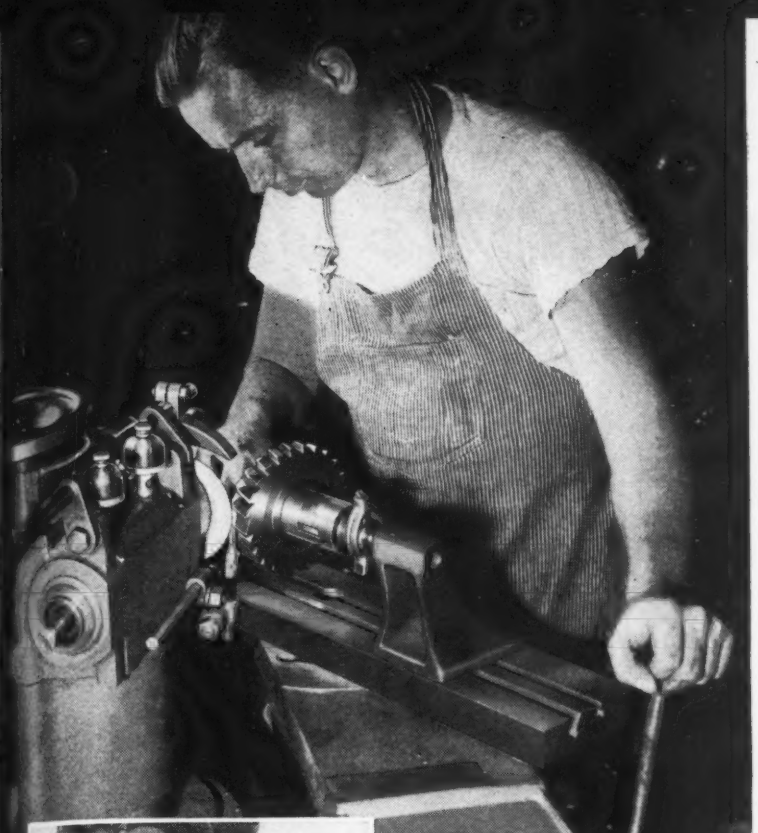
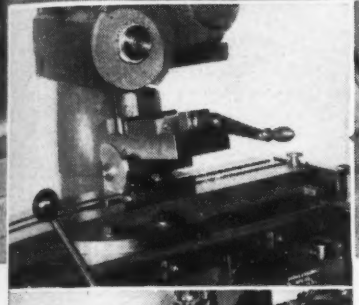
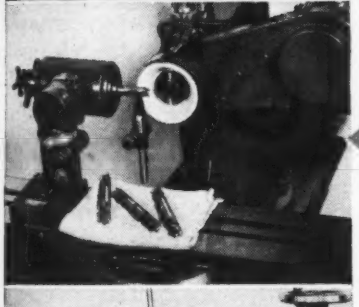




Sharpening Tools held in Adjustable Vise



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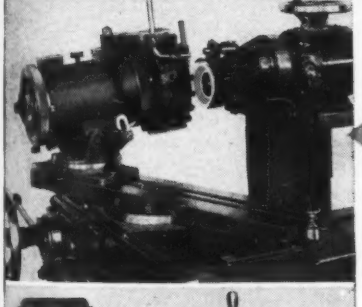

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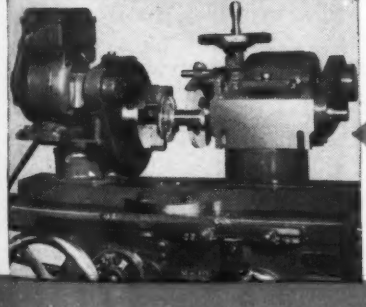

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# Shop Equipment News

*Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market*

## Hydraulic Injection Molding Machine for Thermoplastic Materials

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has recently brought out a hydraulic molding machine designed for injection molding of thermoplastic materials. This new machine has a capacity of 16 ounces and is designated Model 350-H-16. It represents one size of a line of post-war H-P-M "All Hydraulic" injection molding machines in which new developments have been incorporated. Granules of the molding compound are loaded into a hopper on top of the injection unit, measured, and fed into a heating chamber. The materials customarily handled include cellulose acetates, cellulose acetate-butyrates, acrylics, polyvinyl chloride, and vinylidene chloride.

The material is heated in the chamber until it is of plastic consistency, the temperature of the heating chamber being very accurately controlled. After the material has softened into a homogeneous plastic mass, it is forced by a horizontal plunger into the closed and tightly locked mold, which is maintained at a temperature under that of the melting point of the material. The material in the plastic state literally freezes on striking the chilled mold and immediately becomes hard, in which condition it can be ejected from the mold. The mold is opened automatically, the piece ejected, and the proper amount of material again forced into the mold from the heating chamber. The cycle is then repeated rapidly and continuously.

The main ram has a small internal booster ram which advances the clamp platen to within a fractional part of an inch of the totally closed position. At this predetermined position, hydraulic fluid under pressure is shifted to the large ram area. This arrangement permits rapid closing by the booster pump. Forward ram travel of the mold clamp is limited by a hydraulic by-pass which eliminates the need for stop-collars on the tie-rods. The solid forged-steel diehead can be moved forward hydraulically to permit automatic retraction of the mold from the injection nozzle tip. This action also serves to break the sprue.

The injection chamber is mounted in a steel cradle, held in accurate alignment on two tie-rods. All internal surfaces of the injection chamber which come in contact with the plastic material are chromium-plated. A new locking device permits quick removal of the chamber by simply turning it 60 degrees.

Semi-automatic control is obtained by having the main operating valves actuated by solenoids, a single multi-flex timer being provided to control the clamping and injecting actions. Each operating cycle is started by simply moving the clamp control lever. Manual controls for starting and stopping the motor and turning the heat on and off are operated by push-buttons.

Four adjustable rods are provided for operating knock-out bars in the mold. Provision is also made for two additional knock-out rods on the horizontal center line. A safety gate which slides easily on ball-bearing rollers prevents closing the clamp while the gate is in the open position. All water connections for cooling the operating oil, feed chamber, and dies are built into the machine. A centralized valve station facilitates regulating the flow of water to each unit. The machine requires only one water inlet and one drain.

An outstanding feature of this machine is the material heating chamber. It consists of front and rear housings with a removable plunger bushing, as seen in Fig. 2. Bushings can be furnished with various bore diameters to accommodate plungers of corresponding sizes. The torpedo or spreader is

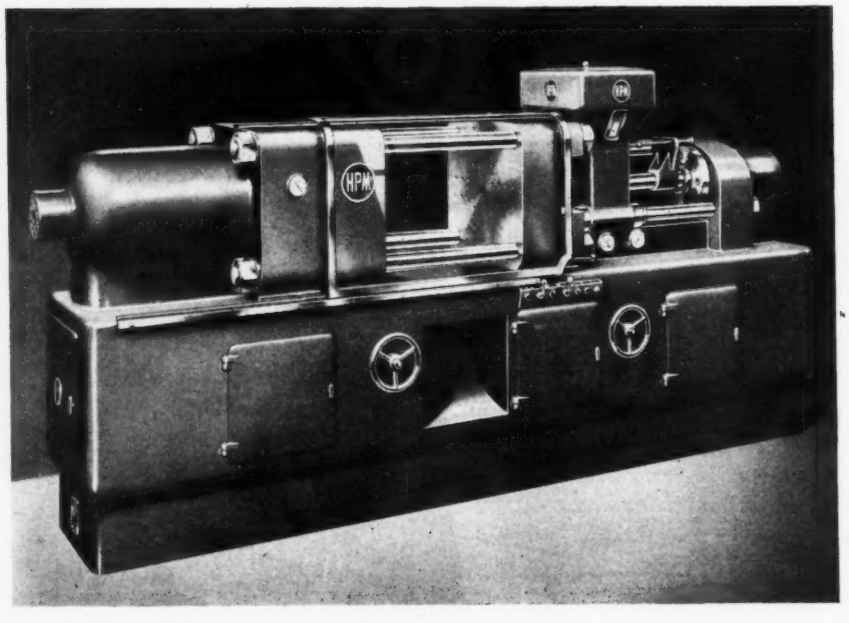


Fig. 1. Injection Molding Machine for Thermoplastics Brought out by Hydraulic Press Mfg. Co.



To obtain additional information on equipment described on this page, see lower part of page 200.

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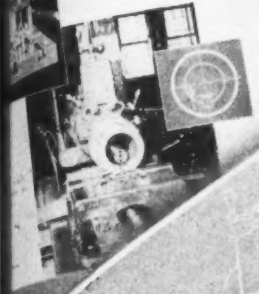




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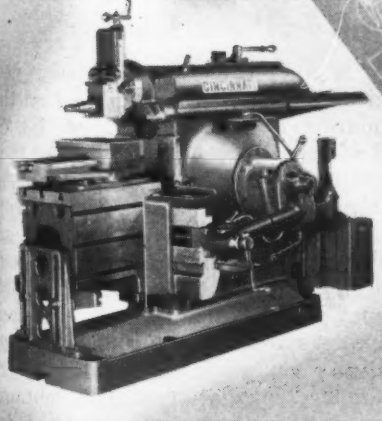

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clamped in position by the front member of the chamber housing. Nozzle tips can be furnished with various size orifices. Tips can be quickly interchanged, and the torpedo member can be removed without removing the chamber.

The heating chamber is designed with two positive heating zones which are separated by an insulating air gap. It is possible to maintain a differential of 100 degrees F. between the two heating zones. By maintaining a higher temperature at the rear of the chamber, the cooling time after the material has been injected into the die can be reduced, thereby permitting a faster over-all machine cycle. The torpedo is also heated; thus molding material is actually heated from the inside as well as from the outside.

The maximum amount of material which can be injected per cycle is 16 ounces. The hopper has a capacity of 100 pounds of material which is the plasticizing capacity of the machine per hour. The clamp capacity for the molds is 350 tons, and the pressure available for separating the molds 22 tons. The horizontal and vertical molding spaces are 20 and 30 inches. The clearance between the tie-rods is 20 1/2 inches horizontally and 19 1/2 inches vertically. The maximum daylight opening is 32 inches, and the minimum mold thickness 12 inches. The mold clamps have a travel of 20 inches.

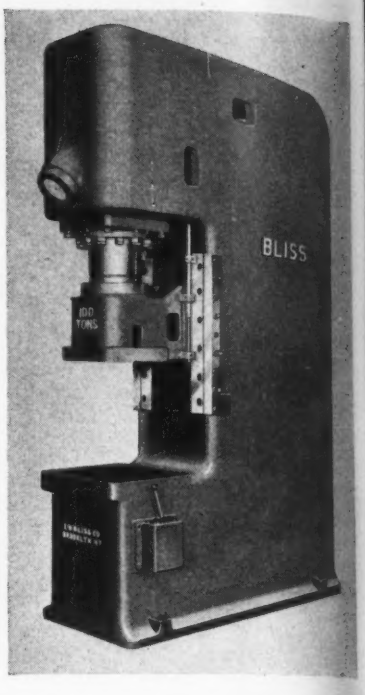
The maximum injection pressure on the material is 20,000 pounds per square inch, using an injection plunger of 3 3/8 inches. Increased injection pressures at reduced capacities can be obtained by equipping the injection unit with interchangeable plungers and chamber bushings of suitable diameters. The injection plunger has a stroke of 12 inches. The heating chamber requires 6 1/2 kilowatts. A 30-H.P. motor drives the machine. The machine occupies a floor space of 185 by 50 inches, and has an over-all height of 91 inches. 51

## Bliss Gap-Frame Hydraulic Press

Features of a 100-ton, general-purpose, hydraulic press of gap-frame construction built recently by the E. W. Bliss Co., Second Ave. and 53rd St., Brooklyn 32, N. Y., include rugged frame construction, smooth enclosures, and a slide that is accurately guided by adjustable gibs. This press is arranged for manual control, but the electric control used on straight-side single-action presses is available for automatic reverse either by pressure or position control.

Various types of pumping units are available for different production requirements. For small production work, the pumps are usually mounted in the frame of the press, while for high-speed production the pump is mounted on top of the frame. The closing speed of the ram is 58 inches per minute; the pressing speed, 8 1/2 inches; and the opening speed, 54 inches.

The bed area of the press is 20 by 20 inches; distance from center line of ram to throat, 15 inches; maximum stroke, 18 inches; height, 145 inches; and weight, 25,000 pounds. 52




Bliss General-purpose Hydraulic Press of Gap-frame Construction

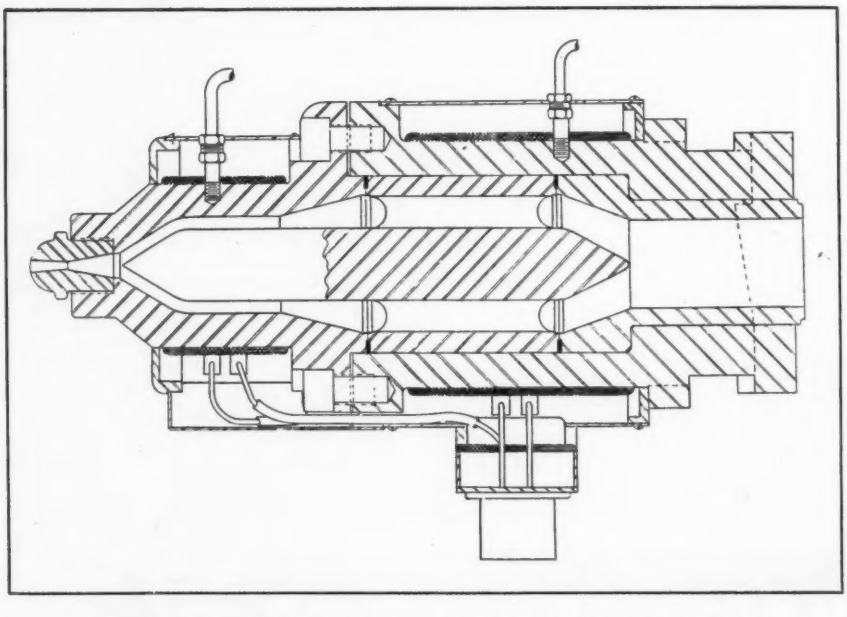


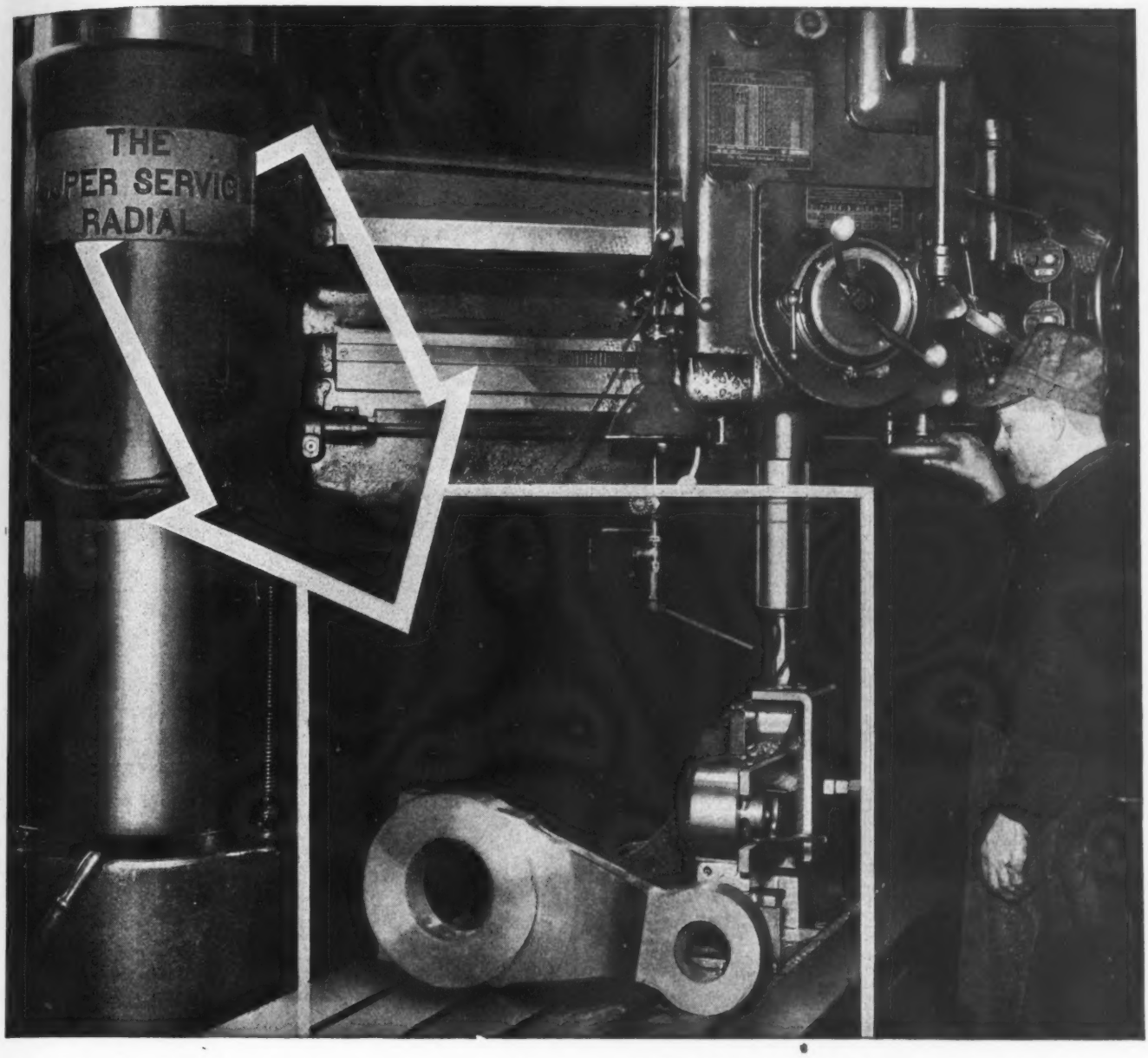
Fig. 2. Cross-section through Material Heating Chamber of Molding Machine Shown in Fig. 1

## Slide-Rule with Decimal-Point Locator

A slide-rule with entirely new graduations has been placed on the market by Pickett & Eckel, 53 W. Jackson Blvd., Chicago 4, Ill. It is claimed that, in addition to being useful for all regular slide-rule calculations, the new slide-rule accomplishes the following four things: (1) It determines the decimal point mechanically in involved expressions for any number of digits or zeros met with in ordinary calculations; (2) obtains on a 10-inch scale, accuracy equivalent to that ordinarily obtained for cube root on a 30-inch scale, and for square root on a 20-inch scale; (3) with one setting of the hair-line, gives readings of square root, cube root, and logarithm,



To obtain additional information on equipment described on this page, see lower part of page 200.




# Another VITAL Application of the SUPER SERVICE RADIAL...

## RAILROAD PRODUCTION

**CINCINNATI BICKFORD ENGINEERING SERVICE IN THE INTEREST OF VICTORY**

**The Cincinnati Bickford Tool Co. is now developing drilling machines that produce victorious results and will continue to hold those high standards for many years to come. The Engineering Staff is not satisfied to rest on laurels that won their Super Service Metal Drilling Machines the slogan of More Holes per Dollar, but they are ever searching for improvements that will continue to keep the Cincinnati Bickford Tool Company's name in that category of one who builds machines that drill MORE HOLES PER HOUR.**

Drilling to close parallelism is an important operation at the American Locomotive Company Plant. The parts so drilled are eccentric cranks which are to be bolted to main crankpins. Long holes are required; specifications call for drilling these holes closely parallel to the vertical center lines passing through both bearings. The machine used for this precise operation (illustrated above) is the **Cincinnati Bickford Super Service Radial with numerous features to insure consistently accurate performances in high speed production of numerous vital products needed for America's gigantic Victory output.** Write to Cincinnati Bickford for detailed information on all models of Super Service Radials and Upright Drills.

**THE CINCINNATI BICKFORD TOOL CO.** OAKLEY, CINCINNATI, OHIO, U. S. A.

with the decimal point located; (4) simplifies slide-rule calculations so that persons with limited mathematical background can correctly locate the decimal point in results obtained from relatively complicated calculations. An instruction manual is available..... 53

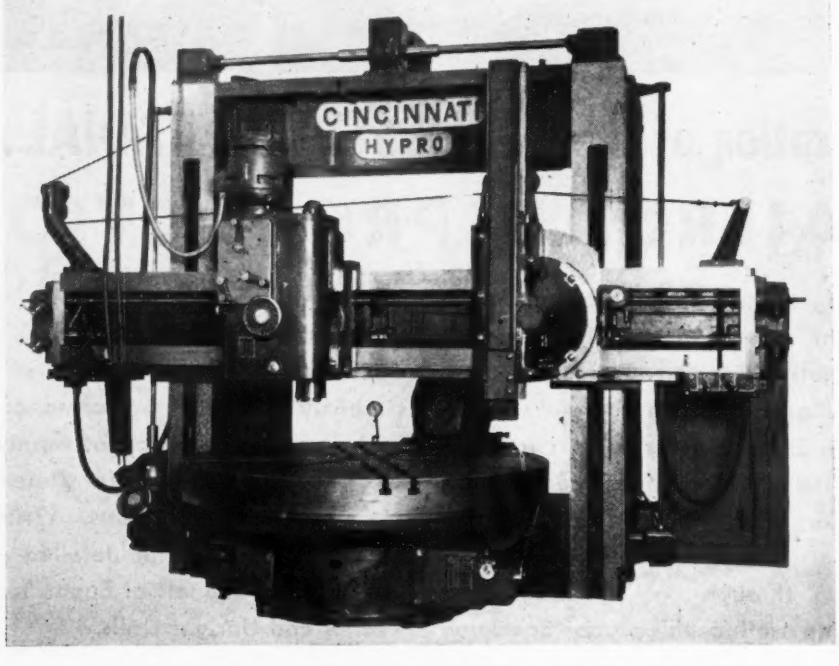
## Cincinnati Combination Boring and Milling Machine

To eliminate complicated set-ups and save time on special production jobs requiring boring and turning operations and the milling of pads or slots in the same set-up, the Cincinnati Planer Co., Cincinnati 9, Ohio, recently built the combination boring and milling machine here illustrated. The table of this machine has sixteen speeds ranging from 1 to 30 R.P.M. A positive device for locking the table is provided for use when the cross-rail feed is employed for milling. This table lock is electrically interlocked with the feed and driving motors to prevent the table from being accidentally moved when set for cross-milling. The table is graduated in degrees and has a convenient fine-feed hand adjustment. The motor drive to the table also provides rotary feeds ranging from 2 to 80 inches per minute for milling operations.

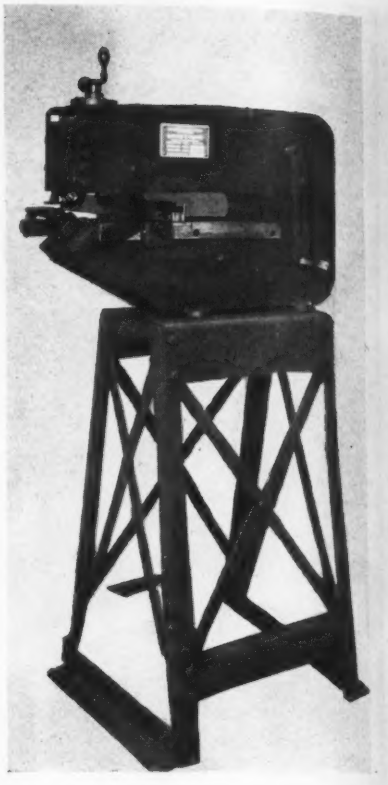
The milling head has a standard 7 1/2-inch quill of the latest Hypro design, and is driven by a 10-H.P. motor. The quill is manually operated and has a 10-inch down feed. The milling head has twelve speeds ranging from 21 to 377 R.P.M. Cross-feeds to the milling head range from 1/2 inch to 8 inches per minute. The controls are so arranged that there can be no confusion in changing from turning and boring to milling operations.

The electrically controlled elevating mechanism of the cross-rail is of simplified design and is completely independent of the other machine functions. Filtered lubrication between the bed and table is furnished by a motor-driven pump, a pressure switch being provided to stop the main motor automatically in case of pump failure.

The boring head feeds range from 1/96 to 0.8 inch, and are obtained by twelve mechanical gear changes. An individual feed and traverse box is provided for each head. The rail, rams, milling head, quill, right-hand housing, and table are equipped with scales. All functions of the machine are electrically interlocked, so that no damage will result from ordinary operating errors. ..... 54




Combination Boring, Turning, and Milling Machine Built for Special Work by the Cincinnati Planer Co.



Quickwork-Whiting Hand-operated Rotary Shear

## Quickwork-Whiting Rotary Shear

The Quickwork-Whiting Division, Whiting Corporation, 15673 Lathrop Ave., Harvey, Ill., has just announced the completion of a new hand-powered rotary shear which is to be known as "No. H-06." This shear has a maximum capacity for cutting No. 16 gage sheets with a slitting gage mounted in the throat. The hand-crank can be adjusted or positioned to facilitate fast, easy operation. This machine can be furnished for bench mounting or with a pedestal, as illustrated.....55

## Briggs Oil Filtration Equipment

The Briggs Clarifier Co., 1339 Wisconsin Ave. N.W., Washington 7, D. C., has recently added two new clarifiers to its line. One of these, known as the Series G clarifier, is made in relatively small capacity units and is suitable for many types of machine tool lubricating systems, hydraulic oil systems, and oil filtration service on mobile, marine, and light- to medium-duty stationary engines.

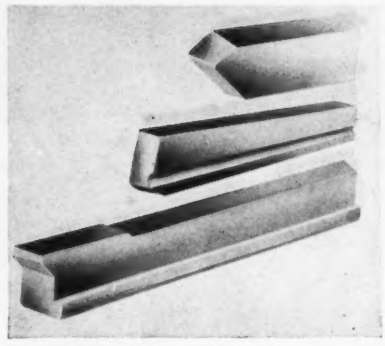


To obtain additional information on equipment described on this page, see lower part of page 200.

The Series F is a fuel oil clarifier designed for Diesel and gasoline engines consuming from 5 to 10 gallons an hour. It is especially adapted to mobile Diesel engines, such as are used in trucks, buses, tractors, etc. The small model—F-5—has proved useful for the filtration of fuel oil in domestic oil burners. ..... 56

## Haynes Stellite Boring and Reaming Blades

Boring and reaming blades of Haynes Stellite cobalt-base alloy have recently been placed on the market by the Haynes Stellite Co., Unit of Union Carbide and Carbon Corporation, Kokomo, Ind. The boring blades are for rough- and finish-boring operations on cast iron, malleable iron, brass, and bronze, and for rough- and semi-finish boring operations on steel. The reaming blades are intended for use chiefly on cast iron, although they have been successfully employed on malleable iron, brass, and bronze. They are not recommended, however, for finish-reaming steel.



Boring and Reaming Blades Made by Haynes Stellite Co.

Both the boring and reaming blades are available in two grades —98M2 and Star J-Metal—the former being especially recommended for boring steel. They can be furnished to suit the user's specifications, finish-ground to the required tolerances. ..... 57

## Tocco High-Frequency Induction Heating Equipment

Two important developments in the field of high-frequency induction heating, to be exhibited by the Tocco Division of Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland 1, Ohio, for the first time at the National Metal Congress, are illustrated in Figs. 1 and 2. The electronic machine, Fig. 1, has two stations that can be independently operated at the same or widely different frequencies. This feature provides great versatility for the brazing, hardening, annealing, heating, or soldering of small parts. The machine has a normal frequency of 450,000 cycles and a 20-kilowatt output capacity.

The new water-cooled silent-operating high-frequency generator, shown in Fig. 2, is hermetically sealed within the strong single-cast frame. Water entering through the lower water line circulates within the unit and leaves through the upper or outlet line. The illustration shows a 200-kilowatt generator unit in position on the heavy cast base.

The machine shown in Fig. 1 is a completely self-contained unit with work-pan, power units, and controls. It is 57 inches wide, 51 inches deep, and 68 inches high. An outstanding feature of this machine is the accessibility of the sub-assemblies, which are mounted as complete units on beds which, in turn, rest on flat metal tracks. This arrangement enables an entire assembly to be slid out of the cabinet without disturbing the rest of the equipment. As shown in the illustration, the controls and operating meters are conveniently located above the work-panels and in the timer cabinet at the left side of the frame. Manual controls for use during set-ups can be quickly switched to automatic control for production runs. The power output control includes plate voltage, grid drive, and grid bias variation. Meters are included for the grid, plate, and radio frequency tank current.

Special filters prevent dirt from entering the forced air cooling system. The work inductors are water-cooled. They can be easily attached to the work-panels, which are moved without difficulty from the horizontal to the vertical position. Tank transformers are located within the machine, which weighs, complete, approximately 2400 pounds.

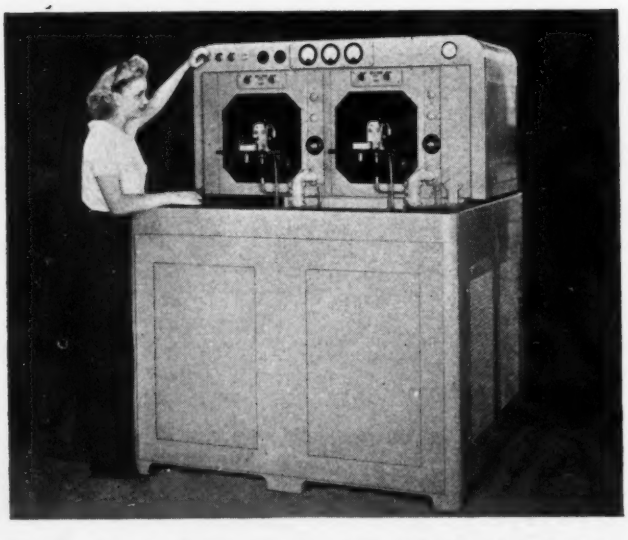


Fig. 1. Tocco High-frequency Induction Heating Machine

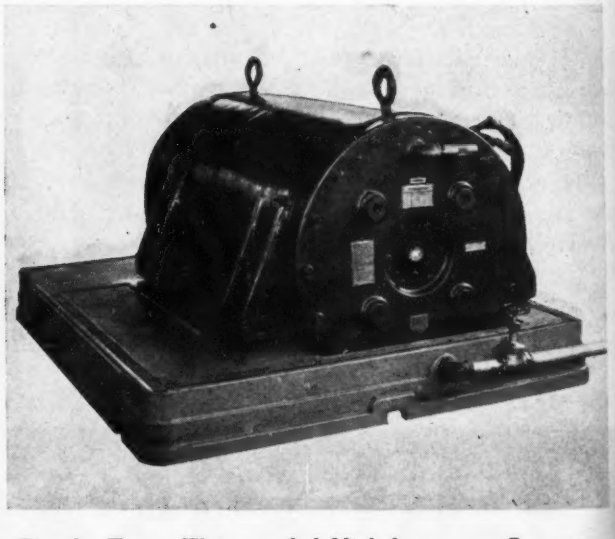


Fig. 2. Tocco Water-cooled High-frequency Generator



To obtain additional information on equipment described on this page, see lower part of page 200.

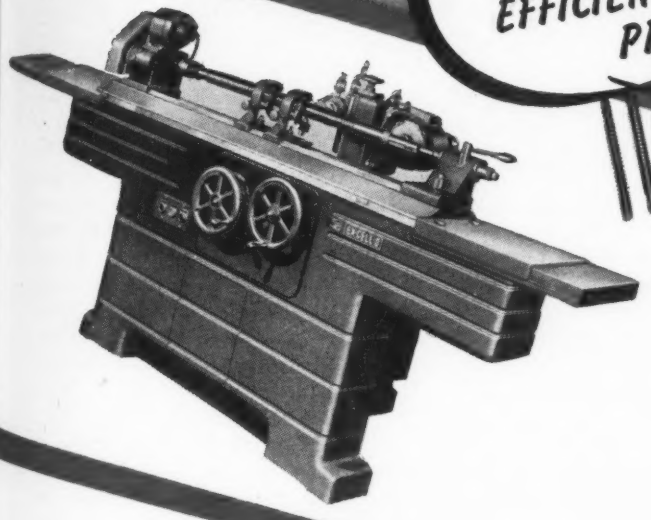
# *Now* . . . EX-CELL-O BROACH SHARPENING MACHINES

**AVAILABLE IN 4 STYLES FOR MOST EFFICIENT PRODUCTION**

**FOUR STYLES**
**EX-CELL-O BROACH SHARPENING MACHINES**

No. 80 Small Machine for Round Broaches
No. 80-L Large Machine for Round Broaches
No. 81 Small Machine for Flat Broaches
No. 81-L Large Machine for Flat Broaches

For further information, write to Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 6, Mich., and ask for specifications on new Ex-Cell-O Broach Sharpening Machines.



**EX-CELL-O—STYLE 80**

For economical sharpening of round broaches. Has heavy base and sturdy, well-supported table. EX-CELL-O precision ball bearing spindle assures freedom from vibration, maximum service life, and a good grinding finish. V-belts and 3-step pulleys allow a practical range of work speeds. Push button controls are on front of the machine.

**EX-CELL-O—STYLE 81-L**

For sharpening flat broaches and grinding straight slots, keyways, and grooves to close tolerances. The cross travel of the spindle is manually operated. Adjustable stops are provided so that spindle travel in either direction can be accurately limited when necessary. Ex-Cell-O broach sharpening machines have been in use in Ex-Cell-O plants.

**MANY years of experience in the production of broaches, broaching fixtures, and precision machine tools form the background for the design and manufacture of Ex-Cell-O broach sharpening machines. Each machine is built to give the utmost in speed, accuracy, and economical production. Each combines simplicity and ruggedness in construction, with modern streamlined appearance. These new Ex-Cell-O broach sharpening machines are special purpose machines. They are ideal for large production set-ups, and are advantageous also for occasional work. By the use of Ex-Cell-O broach sharpening machines, set-up time is highly minimized, the hazard in changing equipment is practically eliminated.**

**EX-CELL-O CORPORATION**
**DETROIT 6, MICHIGAN**

1919 — TWENTY FIVE YEARS XLO OF SERVICE — 1944

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • BROACHES AND BROACH GRINDING MACHINES • HYDRAULIC POWER UNITS • GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS PURE-PAK PAPER MILK BOTTLE MACHINES • PRECISION AIRCRAFT AND MISCELLANEOUS PARTS

Three major features of the new water-cooled generator, Fig. 2, that are now incorporated in all 9600-cycle Tocco induction machines of 50-kilowatt capacity or more are silent operation, even at full operating power; resilient mountings that eliminate vibration; and air-tight design that prevents foreign matter from entering the mechanism and impeding operations.

The outside diameter of the generators of 50-kilowatt output and upward ranges from 33 to 37 1/2 inches, while their length varies from 4 1/4 to 5 2/3 feet. These generators are furnished with either sleeve or ball bearings, as required. Pressure fittings located on the outside of the bearing brackets serve to lubricate all ball-bearing models. With this arrangement, the generator is lubricated about every 700 hours. ..... 58

## Norton "Bura-Way" Precision Tool and Form Grinder

The Norton Co., Worcester 6, Mass., has recently added to its line of grinding machines the "Bura-Way" tool and form grinder, for which it has acquired all design and mechanism patents and drawings, as well as all manufacturing and sales rights. This machine is especially designed to facilitate the grinding of metal-cutting tools with constant relief in the direction of feed. Tools ground in this manner can be quickly and easily duplicated by inexperienced apprentices.

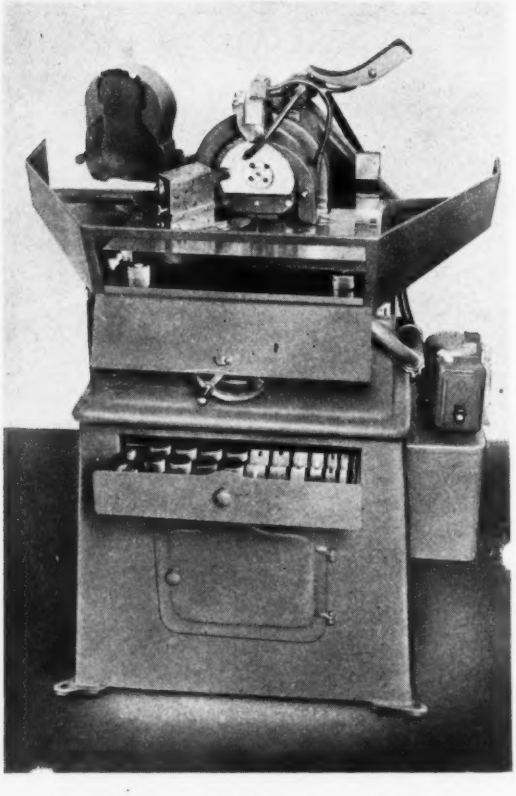
Factors claimed as contributing to the longer life of tools ground on the Bura-Way machine include means for precise control in grinding to the required angles; close control of the amount of metal removed in renewing cutting edges; accurate reproduction of form tools within close dimensional limits; and the production of a fine surface finish at the tool's edge, which increases production per grind and gives a cleaner cut. Relief angles can be controlled within minutes of arc. The unit, which is equipped for wet grinding at present, is suited for the rough- or finish-grinding of tools and for handling high-speed and cast chromium-cobalt steels, as well as carbide-tipped tools. ..... 59

## Anderson Armature Straightening Press

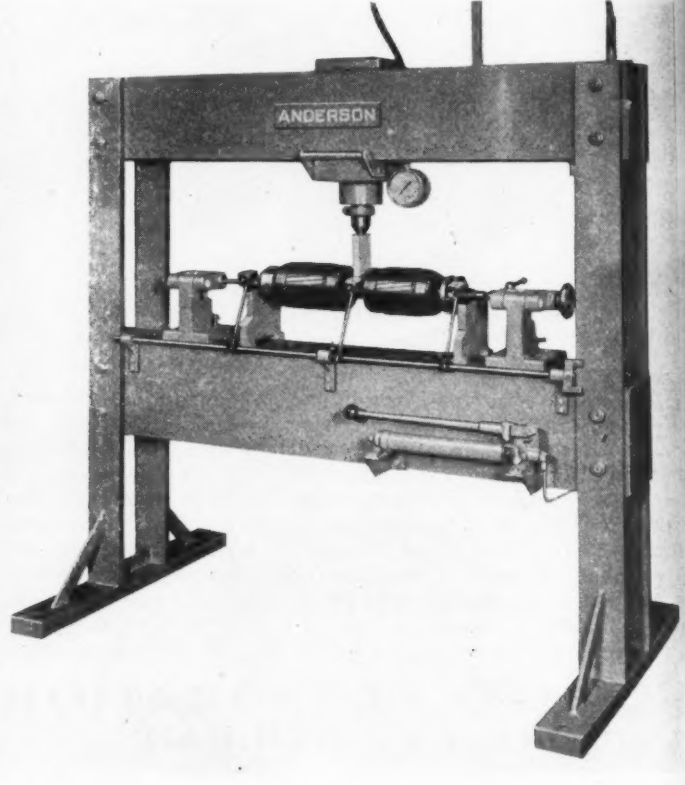
A high-speed armature straightening press is being introduced to the trade by the Anderson Bros. Mfg. Co., 1907 Kishawaukee St., Rockford, Ill. Three or more indicators are employed to check the straightness of the shaft at vital points. These indicators are attached to one pivot shaft, so that they can all be swung into or out of position with one movement of the hand.

The spring-mounted centers are carried on a V-slide to eliminate tipping or accidents when especially heavy armatures are being handled. The ram is of the traveling type, and rolls on four prelubricated ball bearings. The hydraulic gage is mounted directly on the ram, in a convenient location for quick reading.

Armatures up to 14 inches in diameter can be accommodated. The press has a capacity of 20 tons, and a total length of 65 inches. Power is regularly derived from a hand hydraulic pump, but a power-operated hydraulic unit can be furnished as extra equipment. ..... 60



"Bura-Way" Precision Tool and Form Grinder Built by the Norton Co.




Armature Straightening Press Built by Anderson Bros. Mfg. Co.



To obtain additional information on equipment described on this page, see lower part of page 200.

# BALANCE

## ANY ROTATING PART

## FROM ½ OUNCE TO 50 TONS

*with* **GISHOLT DYNETRIC BALANCING MACHINES***

The principle of Dynetric balancing may be used to locate, measure, and correct unbalanced forces in any part that rotates. It is the approved means of eliminating vibration to assure smoother operation, higher efficiency, and longer life. Literature on Gisholt Dynetric Balancing Machines is yours for the asking.

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**GISHOLT MACHINE COMPANY**

*209 East Washington Avenue • Madison 3, Wisconsin*

*Look Ahead . . . Keep Ahead . . . With Gisholt Improvements*

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

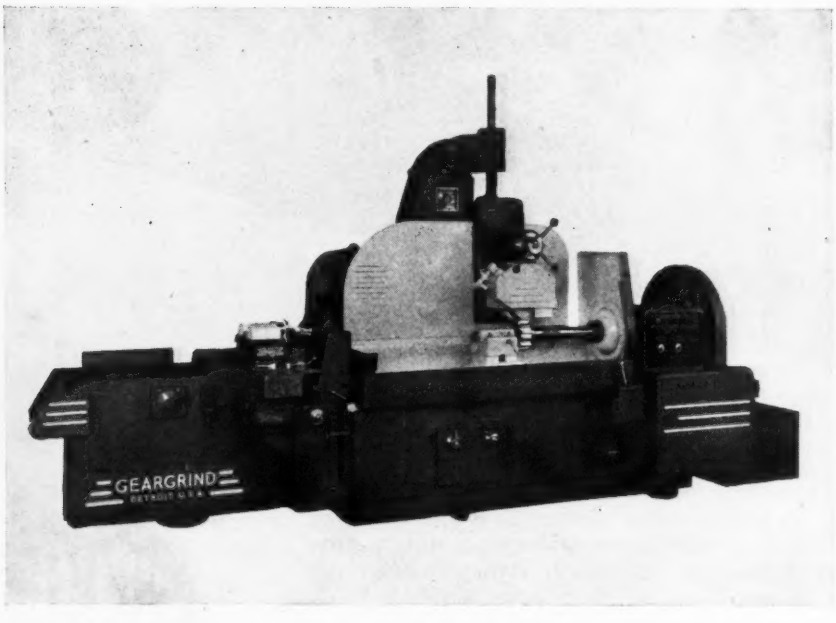
## Heavy-Duty Gear-Grinding Machine

The Gear Grinding Machine Co., Detroit 11, Mich., has just brought out a heavy-duty formed-wheel grinding machine known as "Gear-grind Type GG-24-48." This new machine will grind either coarse- or fine-pitch gears with diameters up to 24 inches, and will take work up to 48 inches long between centers.

Improved features, including faster indexing, more rapid travel of the work-table to and from the work, and simplified push-button controls, make possible exceptionally high production rates. The low base of the machine is especially designed to facilitate handling the work. The work areas of the machine are painted a spotlight buff color to provide better visibility, easier and faster inspection of the work, and greater safety for the operator. New control features permit the indexing mechanism to function at both ends of the stroke or on the tailstock end only, as required. The indexing cycle stop is selective, providing for any number of indexing from 0 to 400, and can be adjusted to function at any point in the cycle.

The travel of the grinding wheel carriage to the wheel-trimming position is accomplished automatically. This movement can be made after any predetermined number of cycles (complete revolution of the work) or it can be operated for tooth-to-tooth indexing. An electrically interlocked safety circuit stops the grinding wheel carriage in case the indexing movement is not properly completed.

The motor-driven work-head spindle is mounted on precision tapered roller bearings, and permits checking the work run-out with an indicator. The 38-inch diameter index worm-wheel is driven by a hardened and ground worm, 4 1/2 inches in diameter, which is mounted on tapered roller bearings. Both the worm and worm-wheel run in oil. The machine takes either a 4 to 1 or a 6 to 1 trimmer. ..... 61




Heavy-duty Formed-wheel Gear-grinding Machine Brought out by the Gear Grinding Machine Co.

## Rieger Circle Cutter and Multifacer

A circle cutter with a cross-arm which is adjustable for cutting holes from 2 to 8 inches in diameter has just been brought out by the Rieger Mfg. Co., Department M-10, Miamisburg, Ohio. A 1/4- by 1/4-inch tool bit of any desired contour is fastened with a set-screw in the holder at the end of the cross-arm, as shown in Fig. 1. The tool can be used in a lathe, drill press, or electric drill, being centered in the work by means of a 1/4-inch stub pilot drill. It is said to have ample strength for machining holes in 1/2-inch plate steel. By the use of a suitable ground bit, the periphery of the hole can be cut to a straight, chamfered, rounded, or stepped form. Fiber, wood, and other flat materials, as well as metal, can be cut with this tool.

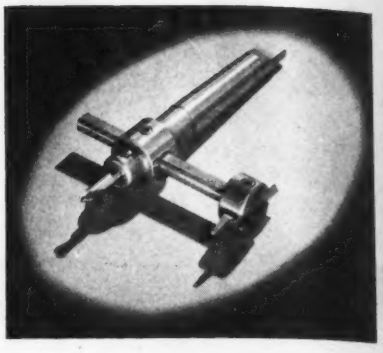


Fig. 1. Rieger Circle Cutter

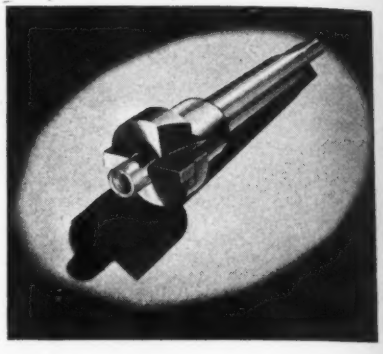


Fig. 2. Rieger Multifacer

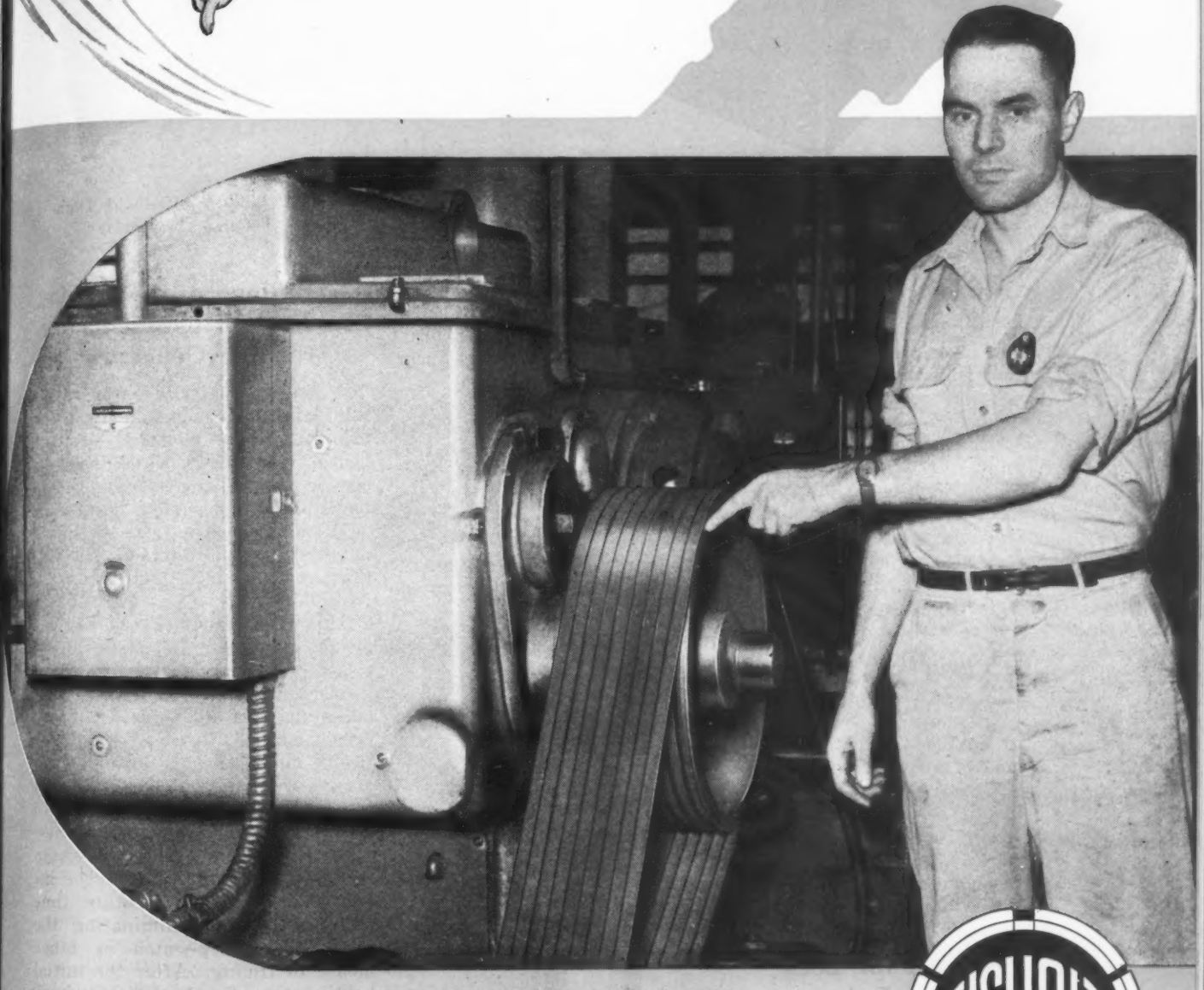
Two regular models of the circle cutter are available, one having a 1/2- by 1/2-inch round shank, and the other a No. 2 Morse taper shank. Special models can be made to order. The tool is constructed of heat-treated alloy steel and ground to size.

The multifacer, shown in Fig. 2, is another Rieger tool being introduced to the trade. It is applicable to drill presses, engine and turret lathes, and milling machines for spot-facing, boring, counterboring, valve-seating and for cutting convex or concave annular rings. The head of this tool is slotted to receive the bit, which is ground to the desired contour. The bit is located by means of three set-screws and can be adjusted to cut evenly, though the grinding of the bit may be somewhat faulty. Clearance slots provide for the escape of shavings and chips. This tool is made in three standard sizes for cuts ranging from 1 to 5 inches in diameter. The tool can be obtained in other sizes on special order. 62



To obtain additional information on equipment described on this page, see lower part of page 200.

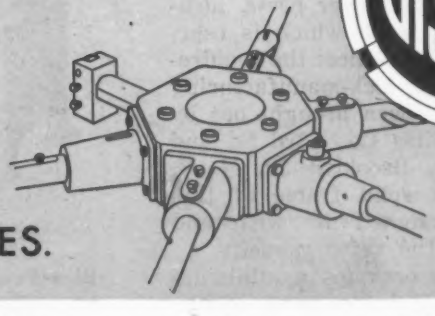
# Don't slip on this one!



**KEEP ALL VEE-BELTS AT PROPER TENSION**

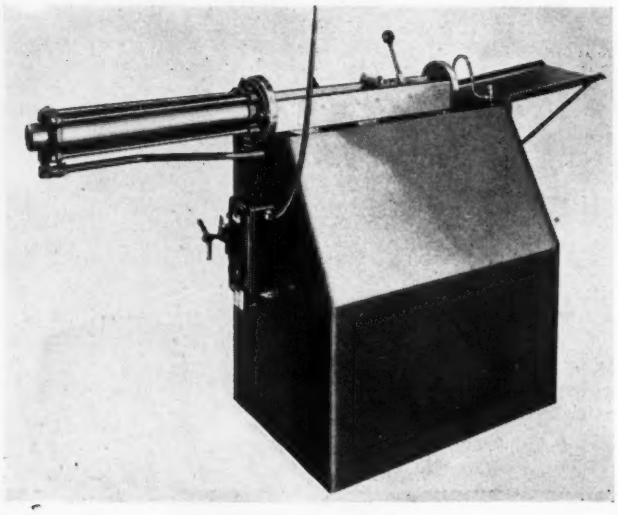
Slipping belts cause loss of power, excess heat and rapid belt wear.

There is no excuse for this waste with the easy belt adjustment provided by GISHOLT TURRET LATHES.



GISHOLT

★ *Reproductions of this page on enameled paper are available for use in your turret lathe department. Write the Gisholt Machine Company, 1209 East Washington Avenue, Madison 3, Wisconsin. Ask for the series of "Wartime Care and Operation" posters. State quantity desired.*



Zagar Broaching Machine Designed to Handle Small Parts Requiring Accurate Machining

Hardening and Quenching Table for Use with High-frequency Induction Heating Generators

## Zagar Broaching Machine

A hydraulic broaching machine designed to meet the demand for rapid, accurate broaching of small parts has been placed on the market by Zagar Tool, Inc., 23886 Lakeland Blvd., Cleveland 17, Ohio. The machine has a self-contained coolant system with a 3 1/2-gallon coolant tank; hardened and ground ways and adapter plate; automatic stop control, as well as hand control; and hydraulic cylinder.

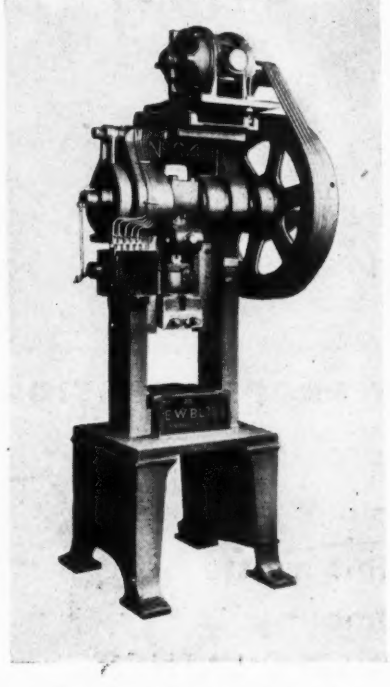
Broaches up to 1 3/4 inches in diameter, of either the key, threaded, or grooved type, can be used. The cutting speed is variable, the set rate being 30 inches per minute. The maximum pull exerted on the broach is 6000 pounds. The machine base requires a floor space of 2 by 3 feet, and has an over-all length of 63 1/2 inches. It is driven by a 3-H.P., 220-volt, three-phase, 60-cycle motor, and weighs 1250 pounds. ..... 63

## Press Designed for Lock-Manufacturing Industry

A mechanical power press, identified as No. S-40, which is especially designed to meet the requirements of the lock-manufacturing industry, has been brought out by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn 32, N. Y. The compact solid frame of this press is designed to withstand loads above the rated capacity.

This press occupies a minimum floor space. It is equipped with a semi-automatic lubricating system. Many standard parts of Bliss design, such as the clutch, brake collar, slide, and pitman, are incorporated in this press.

The operating speed is about 125 strokes per minute, but production can be considerably increased by using single- or double-roll feeds. The feed can be operated from front to back or vice versa. The maximum rated capacity is 40 tons. The bed area is 14 by 14 inches; the stroke, 3 inches; and the die space, 10 inches. ..... 64



Bliss Press Designed for the Lock-manufacturing Industry

## Hardening and Quenching Table for High-Frequency Heating Generators

A general-purpose, two-station hardening and quenching table for use with high-frequency induction heating generators, which is adapted for a wide variety of machine parts requiring surface hardening or localized heating, has been announced by the Induction Heating Corporation, 389 Lafayette St., New York 3, N. Y.

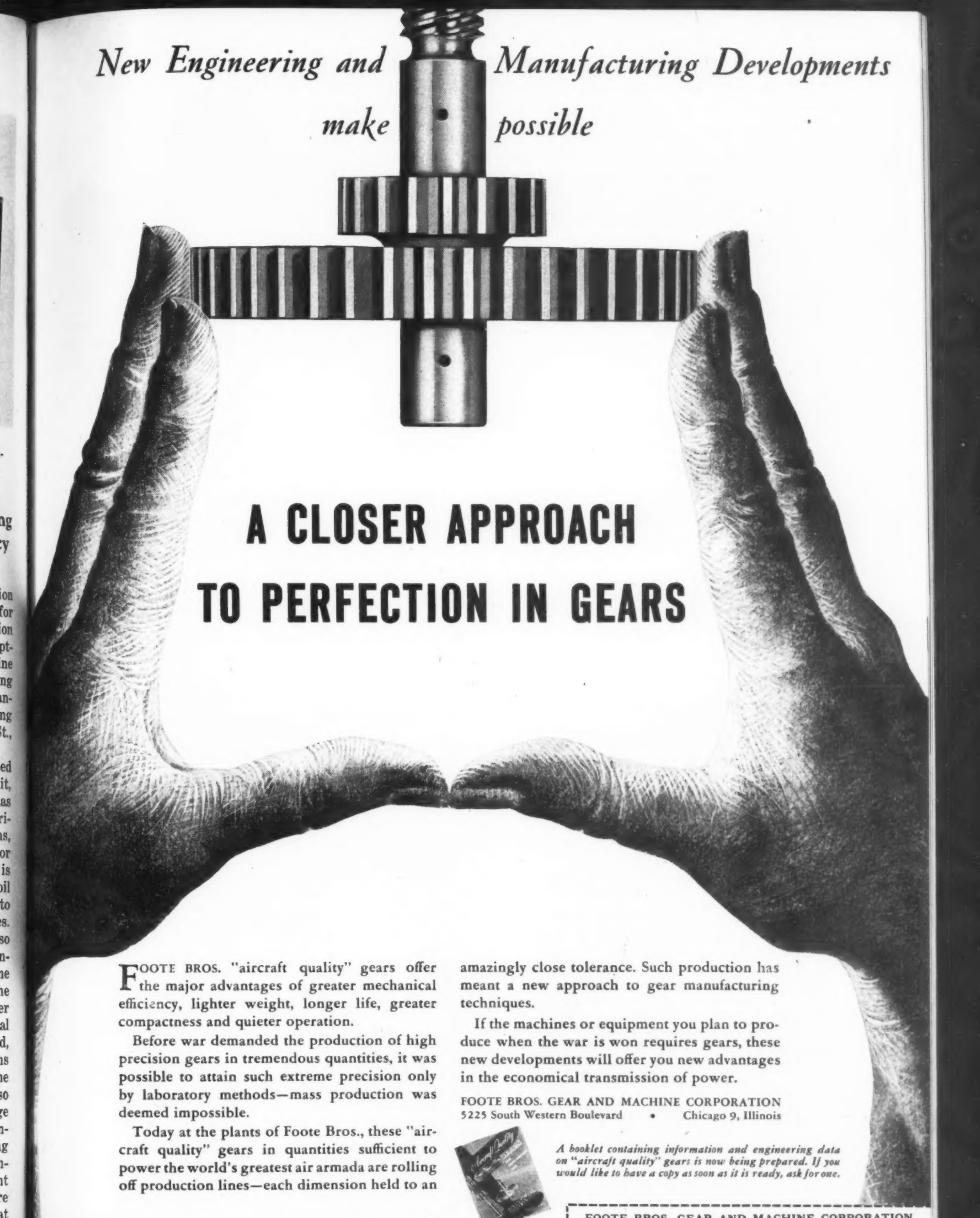
This equipment can be used either as a single-purpose unit, using two identical fixtures, or as a general-purpose table for various kinds of hardening operations, even where lots as small as six or twelve pieces are handled. It is arranged with quick-change coil connections which permit jobs to be set up in two or three minutes.

An initial timer is provided, so that when a new part is to be induction heated, the heating time will be recorded, eliminating the need for a stop-watch or other means of timing. After the initial heating time has been determined, the timer can be cut out by means of a selector switch in the time assembly unit. The table is also equipped with a master three-stage timer, which automatically controls the heating and quenching positions of the cycle. Hose connections are provided at the front of the panel which, in turn, are connected to quench rings that surround the part being heated, thus permitting the application of a spray type quench.



To obtain additional information on equipment described on this page, see lower part of page 200

*New Engineering and Manufacturing Developments make possible*



# A CLOSER APPROACH TO PERFECTION IN GEARS

FOOTE BROS. "aircraft quality" gears offer the major advantages of greater mechanical efficiency, lighter weight, longer life, greater compactness and quieter operation.

Before war demanded the production of high precision gears in tremendous quantities, it was possible to attain such extreme precision only by laboratory methods—mass production was deemed impossible.

Today at the plants of Foote Bros., these "aircraft quality" gears in quantities sufficient to power the world's greatest air armada are rolling off production lines—each dimension held to an amazingly close tolerance. Such production has meant a new approach to gear manufacturing techniques.

If the machines or equipment you plan to produce when the war is won requires gears, these new developments will offer you new advantages in the economical transmission of power.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago 9, Illinois



*A booklet containing information and engineering data on "aircraft quality" gears is now being prepared. If you would like to have a copy as soon as it is ready, ask for one.*

FOOTE BROS.

*Better Power Transmission Through Better Gears*

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Please send me a copy of the Engineering Bulletin on "Aircraft Quality" Gears as soon as it is available.

*Name*.....*Position*.....
*Company*.....
*Address*.....
*City*.....*State*.....

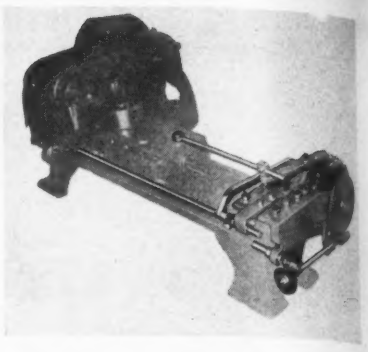
Two rotary-driven spindles are provided for use in hardening parts such as gears, where a slow rotary motion is required to assure uniform heating. The control includes a selector switch for each spindle, so that rotation can be cut out when it is not needed. A cover plate for the sink provides a flat-top table for brazing, soldering, or other forms of metal-heating operations. The table may be equipped with fixtures of different types for progressive hardening of shafts and screws, as well as with indexing and rotary type fixtures. .... 65

## Delta-Milwaukee Dust Collector

A compact, self-contained dust collector unit designed for use with individual grinding, polishing, buffing, sanding, or similar machines has been brought out by the Delta Mfg. Co., 620 E. Vienna Ave., Milwaukee 1, Wis. This unit can be easily attached to any one of the several Delta-Milwaukee machine tools provided with special fittings.

The powerful fan of this dust collector draws in both fine and heavy dust and small particles through an air filter. The larger particles fall into a pan which can be easily removed. The filter is of the permanent, cleanable type, having low air resistance, and is completely fireproof. A special woven-glass filter is also available for use in collecting "flour-fine" dust. The latter filter can be attached directly to the standard filter.

The pressed-steel cabinet houses the squirrel-cage type fan, which is capable of moving 350 cubic feet of air per minute, developing a static suction of 3 to 4 inches. Power is furnished by a 1/3-H.P., 3450-R.P.M. motor having sealed ball bearings. The motor is locked in a separate compartment, which is insulated to prevent the entrance of dust. ..... 66



Attachment for Converting Hand Type Bench Turret Lathe for Automatic Operation

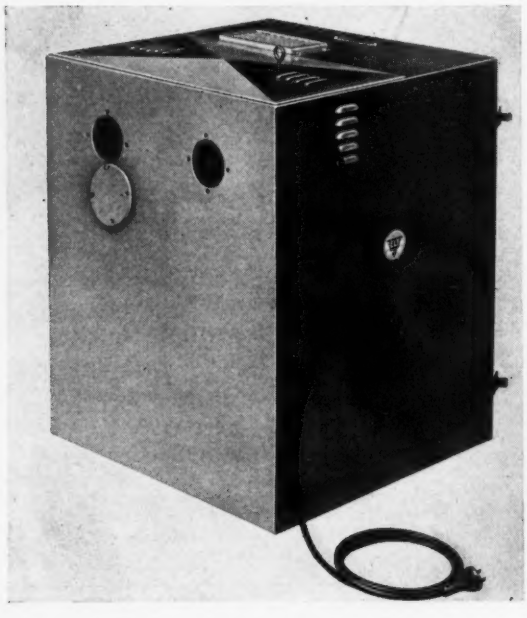
## Attachment for Automatic Actuation of Bench Turret Lathes

Hand-operated turret-equipped bench lathes can be converted into automatics by an attachment designated "Newton Automat," which is being built by the Newton Mfg. Co., 706 N. Heliotrope Drive, Los Angeles 27, Calif. This attachment is designed to actuate the cross-slide, bed turret, and chuck, eliminating all manual operations except the original set-ups and cutting-tool replacements.

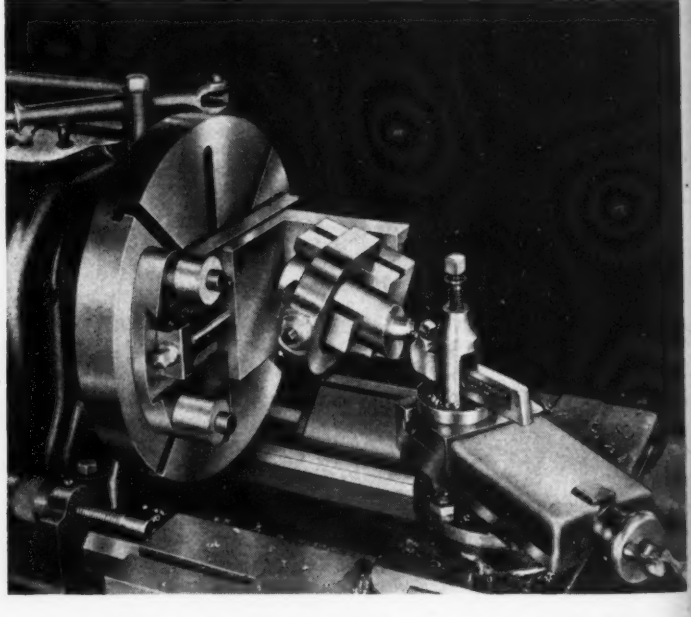
It is of simple, rugged construction, and is equipped with a set of standard cams designed to handle most jobs. The cross-slide is operated by a torque rod, which cushions the shock of forming and cutting operations and assures uniform feed, accurate repeat operations, and long tool life. An automatic cut-out can be adjusted to eliminate damage to the tool and work. A Schrader three-way valve serves to operate any pneumatic collet-closing device. ..... 67

## Lathe Angle-Plate with Accessories

Many unusual machining operations can be performed by the use of an angle-plate attachment for lathes of 14- to 16-inch swing brought out by the Best Tools Corporation, 482 Sunrise Highway, Rockville Centre, N. Y. This angle-plate, known as No. 51, has been



Delta-Milwaukee Self-contained Dust Collector



Lathe Angle-plate with Clamping Device for Round Stock



To obtain additional information on equipment described on this page, see lower part of page 200.

# *Short Cut* ON MACHINING NITRIDED STEEL

## SUNOCO
### EMULSIFYING CUTTING OIL
### speeds cutting of aircraft cylinders at 266 S.F.P.M.

Shortening the cutting time on vital machining operations is one important way Sunoco Emulsifying Cutting Oil is aiding our successful war production effort.

Airplane engine cylinders, for instance, were needed in a hurry. Working with tough nitrided steel, on Jones and Lamson 16" Heavy Duty Fay Automatic Lathes, a cutting lubricant was needed that would permit maximum cutting speed . . . without sacrificing accuracy or finish. On the basis of past experience a 20 to 1 mixture of Sunoco was recommended. The results speak for themselves. The 5/16" cut was made at a speed of 266 S.F.P.M., with all other requirements satisfactorily met.

Flooding tools and work with Sunoco Emulsifying Cutting Oil has been a universal means of speeding cutting operations for years. Sunoco's high heat-absorbing and lubricating qualities make possible longer tool life, greater accuracy, and finer finish.

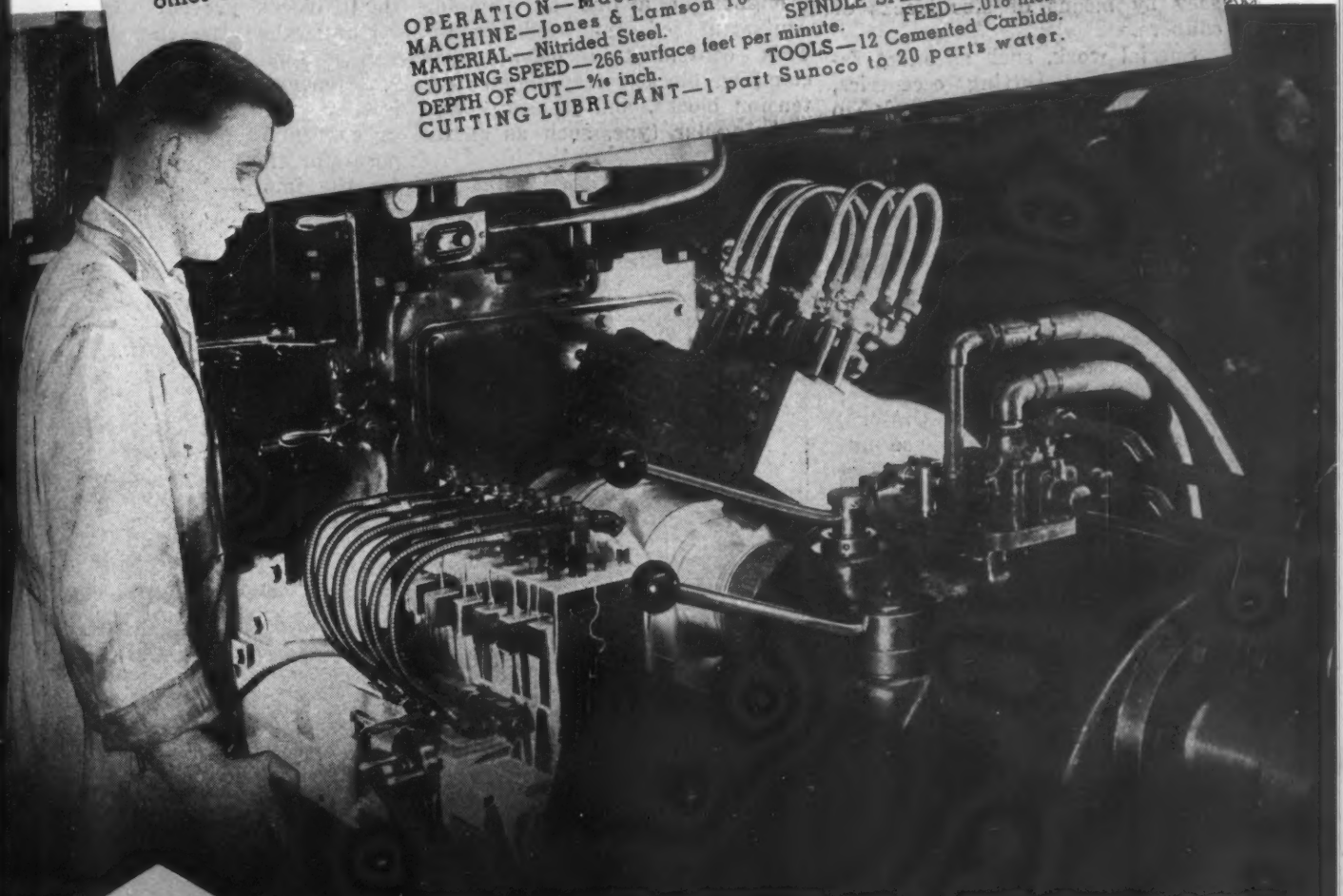
Today, in your own shop, under your own operating conditions, the advantages of Sunoco can be applied wherever a soluble cutting oil is used. Sun Cutting Oil Engineers — experts in solving metal working problems — are at your service to analyze your cutting oil needs and make proper recommendations. Call your nearest Sun Oil Company office or write

**SUN OIL COMPANY • Philadelphia 3, Pa.**

*Sponsors of the Sunoco News Voice of the Air—Lowell Thomas*

PERFORMANCE DATA

OPERATION—Machining Airplane Engine Cylinder.
MACHINE—Jones & Lamson 16" HD Fay Automatic Lathe.
MATERIAL—Nitrided Steel.
CUTTING SPEED—266 surface feet per minute.
SPINDLE SPEED—116 R.P.M.
DEPTH OF CUT—5/16 inch.
FEED—.018 inch.
CUTTING LUBRICANT—1 part Sunoco to 20 parts water.
TOOLS—12 Cemented Carbide.



SUNOCO

## SUN INDUSTRIAL PRODUCTS

*HELPING INDUSTRY HELP AMERICA*

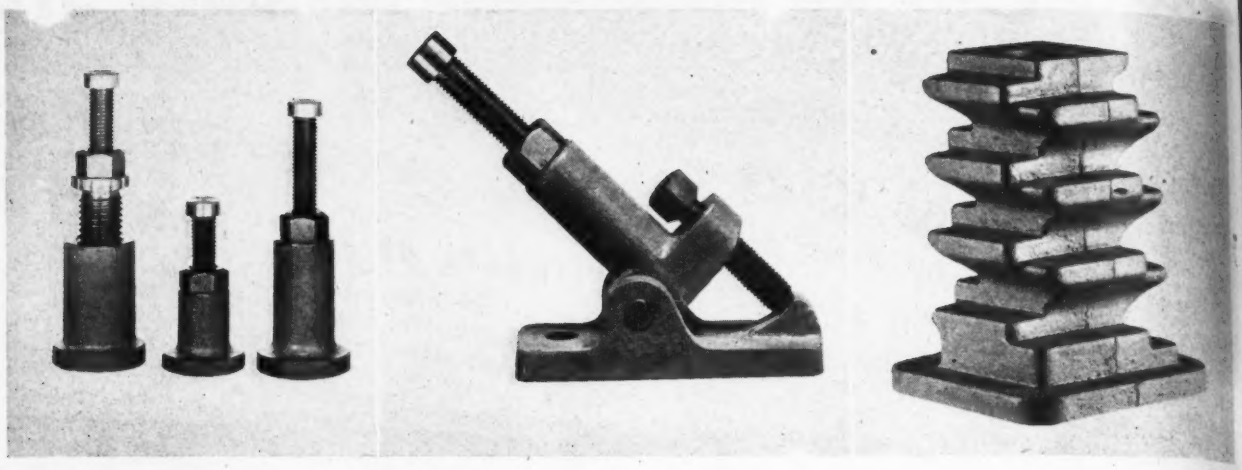


Fig. 1. Russell Streamline Clamping Equipment

developed to eliminate the need for special jigs and fixtures in handling intricate lathe work. The attachment is positioned on the lathe faceplate by a locating nose plug in the headstock spindle, and is then bolted to the faceplate. It is equipped with an adjusting screw and gages to facilitate locating the work with a high degree of accuracy by means of size blocks or calipers.

Special work, such as offset radius turning, cutting eccentrics, angle boring, turning work to compound angles, as shown in the illustration, etc., can be readily performed with the aid of this attachment. It is especially adapted to jig and fixture work where straight or angular holes must be accurately drilled and spaced.

Among the accessories furnished are clamps for holding various shapes of stock. One consists of an adjustable clamping saddle for holding straight stock. Optional accessories include a multi-use unit adapted for such work as offset angle boring and turning, boring turret heads, etc. Round stock up to 2 1/2 inches in diameter can be handled on the unit illustrated. An accessory which is especially useful for holding die-plates for line-boring holes to close tolerances is also available. With this equipment, work of practically any shape can be drilled and finish-bored from solid stock. The square clamp furnished as standard equipment permits handling work up to 5 by 5 by 5 inches. The angle-plate can be located about 5 1/4 inches off center. With the proper arrangement of fixtures, plates up to 5 by 10 by 1 inch can be handled.—68

## Russell Improved Clamping Equipment

To provide means for overcoming the difficulties so frequently experienced in securing work on the beds and tables of machine tools and to enable work-clamping in general to be handled more efficiently, the Russell Machine Co., Kinsman Road, Novelty, Ohio, has brought out a line of clamping equipment of improved design. This equipment includes spiral clamping blocks, strap clamps, extension blocks, and jacks of plain and angular type, such as shown in Figs. 1 and 2.

Spiral clamping blocks like the one shown at the right in Fig. 1 and designated "SCB-4" in the set-up shown in Fig. 2 provide a convenient, practical, and safe support for strap clamping of forgings and castings. These blocks are made in square and rectangular forms with from eight to eighteen steps spaced at 1/8 to 9/16 inch intervals, according to the size of the blocks. The machined bases of these blocks prevent slipping or rocking when the clamping pressure is applied.

Extension blocks, such as designated "EB-45" in Fig. 2, serve as convenient supplementary supports for the clamping blocks and for the improved jacks shown at the left in Fig. 1 (designated "SJ-4" in Fig. 2). These plain jacks are available in a variety of sizes,

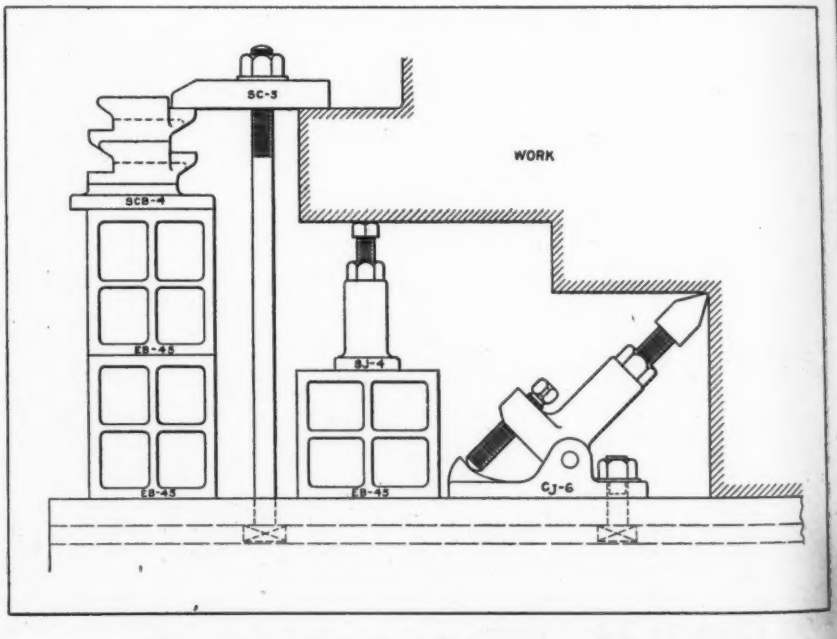



Fig. 2. Set-up Using Russell Angular and Plain Jacks



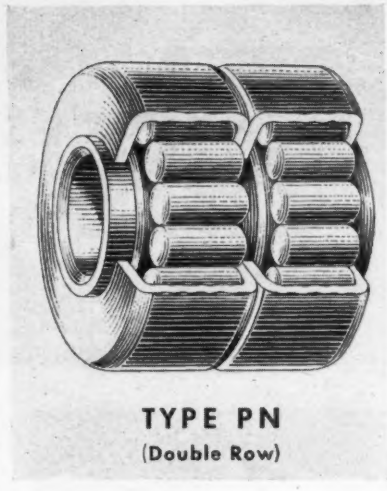
To obtain additional information on equipment described on this page, see lower part of page 200.

as are the angle type shown in the center view, Fig. 1, and indicated as "CJ-6" in Fig. 2.

The somewhat complicated set-up shown in Fig. 2 is simplified by the use of a combination or angular jack and a plain jack for bracing the work. ..... 69

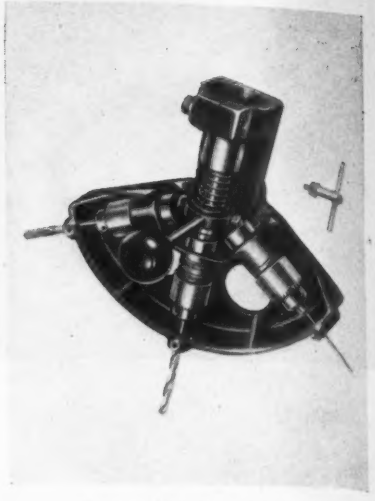
## Needle Bearing for Aircraft Pulleys

A double-row "Model PN" needle bearing which is said to have a friction coefficient as low as that of any type of anti-friction bearing has been announced to the trade by the Torrington Co., Torrington, Conn. This bearing is especially designed to minimize friction in aircraft pulley applications. It conforms to all requirements of Specification AN-FF-P-796. The full complement of small-diameter needle rollers provides ample capacity to meet all standard Government and individual aircraft company requirements.




Torrington Needle Bearing for Aircraft Pulleys

Light weight and small outside diameter are important features of this bearing. Ample space is provided for lubricating oil, which is retained without danger of excess grease impeding operation at low temperatures. ..... 70



Turret Head Attachment for Drill Press

## Universal Drill Press Turret Head

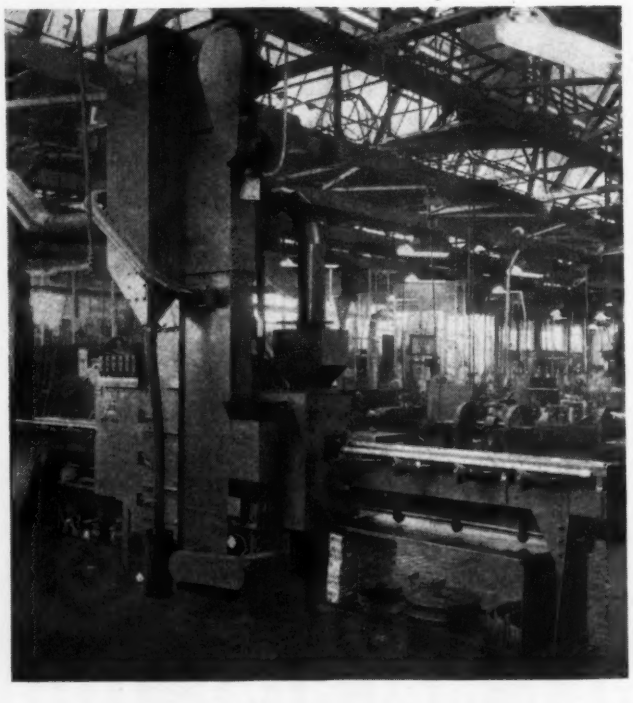
The Universal Engineering Co., 2230 National Ave., San Diego 2, Calif., has placed on the market a novel multiple tool-holder for drill presses. The three-position turret can be clamped on the quill of any standard drill press to give the operator immediate use of three different drills or other tools. This permits continuous operation without loss of time in moving the work from one drill press to another, hence effecting a considerable saving in machines, jigs, and time.

The turret head is attached by simply removing the drill chuck and depth gage and slipping the bracket over the quill. The turret has been designed for maximum strength, yet is light in weight and built to give years of service. It is so constructed that it provides sufficient clearance for most types of jigs and fixtures, and can be easily shifted from one position to another by a light movement of the indexing lever. All parts are interchangeable and especially designed to insure a long useful life. It will take up to 1/4-inch drills, Jacobs 1/4-inch capacity chucks being furnished as standard equipment. ..... 72

## Shot-Peening Metal Parts for Longer Fatigue Life

To increase the life of stressed parts such as gears, springs, axles, crankshafts, connecting-rods, etc., by shot-peening, a line of machines known as "Wheelapeening" equipment has been brought out by the American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind. In these machines, a rain of metallic shot is directed at high velocity against the part to be peened. Each shot striking the surface makes a tiny dent or pit, so that the cumulative effect is to stretch the surface layers by cold-working and to put them in a state of residual compression. Since failure occurs under tension stresses and not under compression stresses, fatigue cracks do not get a chance to start.

In the Wheelapeening machine, the parts to be peened are conveyed through the machine in such a way that all surfaces of the parts are exposed to the peening action. Several models of machines are available to give different combinations of motion for parts of various shapes and sizes. ..... 71



"Wheelapeening" Machine Brought out by the American Foundry Equipment Co.



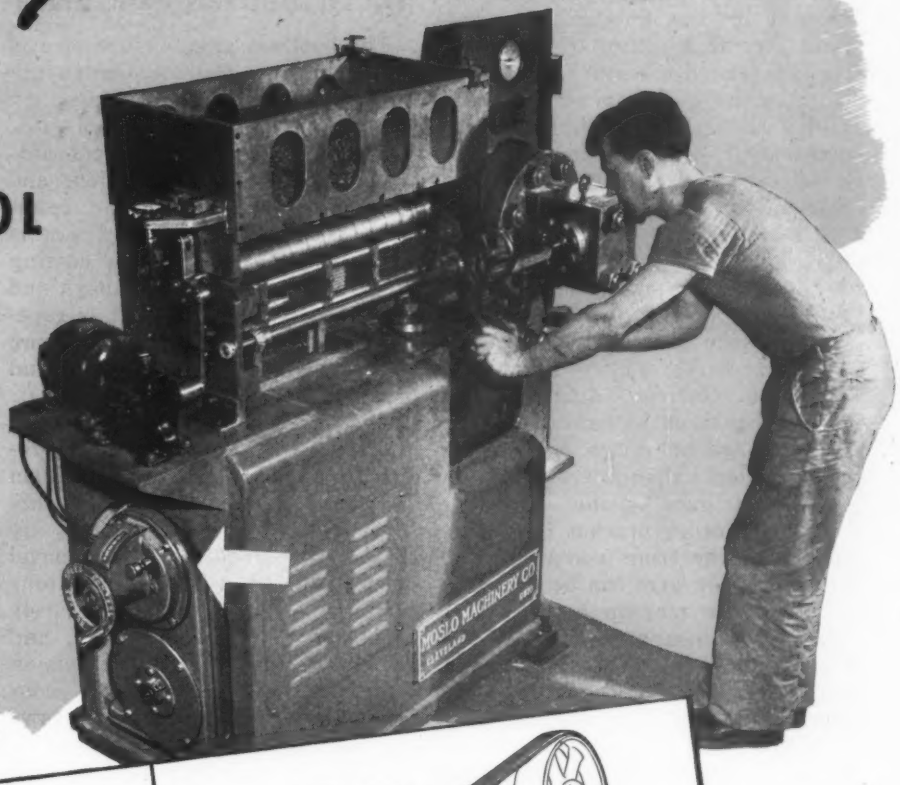
To obtain additional information on equipment described on this page, see lower part of page 200.

# Industry's Preferred

## METHOD OF SPEED CONTROL

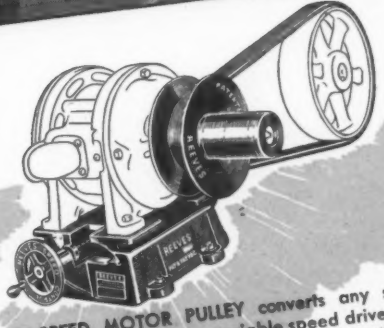
The definite preference of plant superintendents, machine shop foremen, expediters and operators for REEVES Variable Speed Control is not hard to understand. No other speed control is so flexible, so infinitely variable, so positive and dependable in operation. No other offers so many types and sizes of units to meet every installation requirement. Get full information from Catalog offered below.

REEVES PULLEY COMPANY, COLUMBUS, IND.

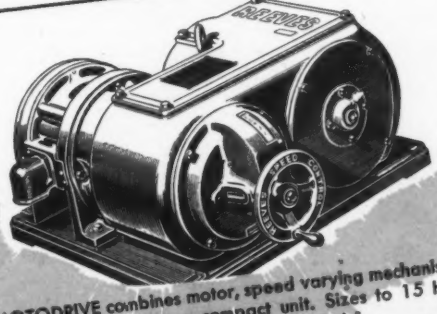




VARIABLE SPEED TRANSMISSION for infinite speed adjustability over wide range of speed ratios, 2:1 through 16:1 and in sizes to 87 horse power.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Sizes to 15 h.p. Speed variation within 4:1 ratio.



MOTODRIVE combines motor, speed varying mechanism, reduction gears in one compact unit. Sizes to 15 h.p. Speed variation 2:1 through 6:1.

★

**NEW CATALOG**

This authoritative 128-page book on variable speed control describes the complete REEVES line of speed control equipment. Ask for Catalog-Manual M.

★


# REEVES *Accurate Variable* Speed Control

## Sheffield Height Indicator

A new type of precision height indicator with "Electrigage," designed to give a quick, positive, and accurate reading, has been developed by the Sheffield Corporation, Dayton 1, Ohio. This indicator is intended for use on a surface plate in the tool-room or wherever highly accurate inspection work is necessary. The instrument includes a surface-plate block, a 26-inch column with rack, and a Sheffield "Electrigage" of 1000 to 1 amplification with 0.0001-inch graduations.

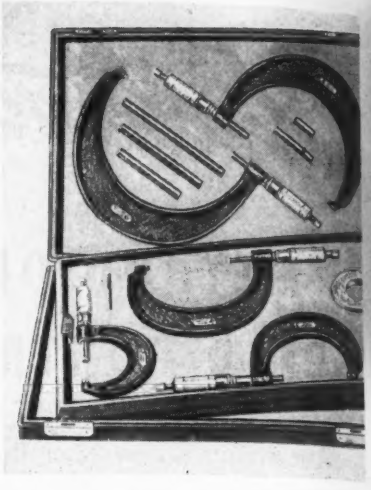
The electric pick-up head of this equipment is mounted on an adjustable extension arm. A micrometer is provided for use in making 3/32-inch vertical adjustment of the pick-up head to permit a much wider range of rough comparison measurements than is possible with the "Electrigage" alone.

The mounting bracket is adjustable vertically from 0 to 18 inches. The extension arm can be adjusted to bring the pick-up head to any position. It has a throat capacity from gaging point to edge of column of 4 1/2 to 11 inches, and from gaging point to edge of base of 3 1/2 to 10 inches. The pick-up head can be rotated and locked at any angular position within a full circle range of 360 degrees. A fine-adjustment knob is provided to facilitate setting up. ..... 73

## DoAll Buttress Saw Blade

The buttress saw blade shown in operation in the accompanying illustration has been developed by the DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., to lessen operator fatigue, speed up production, and eliminate resharpening and resetting of the saw teeth. The saw is designed for long life in cutting ferrous and non-ferrous alloys and non-metallic materials. It is especially adapted for the rapid cutting of aluminum, magnesium, and Kirksite, as well as alloy steels.

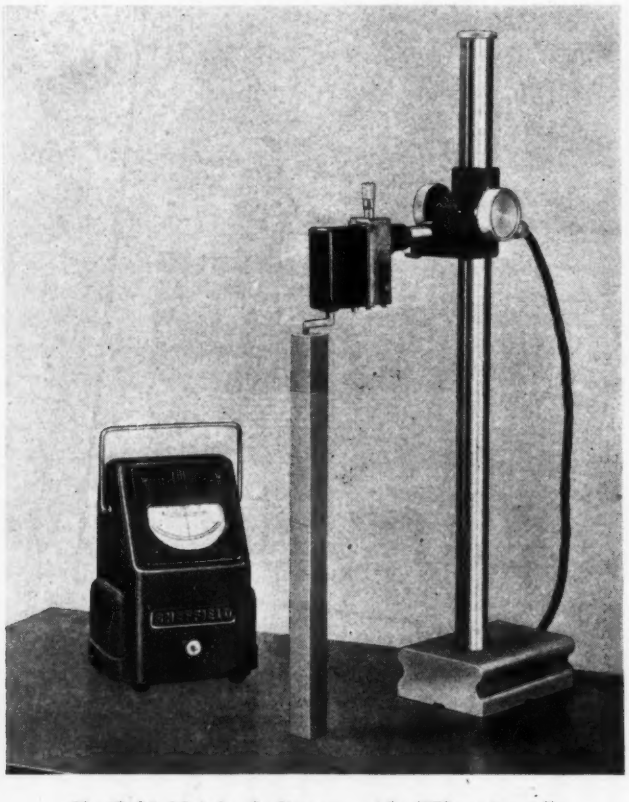
The teeth, of improved design, are claimed to permit rapid production and to maintain parallelism and close tolerances over the surface finished. Tooth gullets are elongated to facilitate the removal of chips and to assure cool contour cutting. The teeth are securely anchored to withstand shock, and are made fast in their precision set positions by accurately controlled heat-treatment. These saws are manufactured in widths of 1/4 to 1 inch, with various sets and pitches. ..... 74



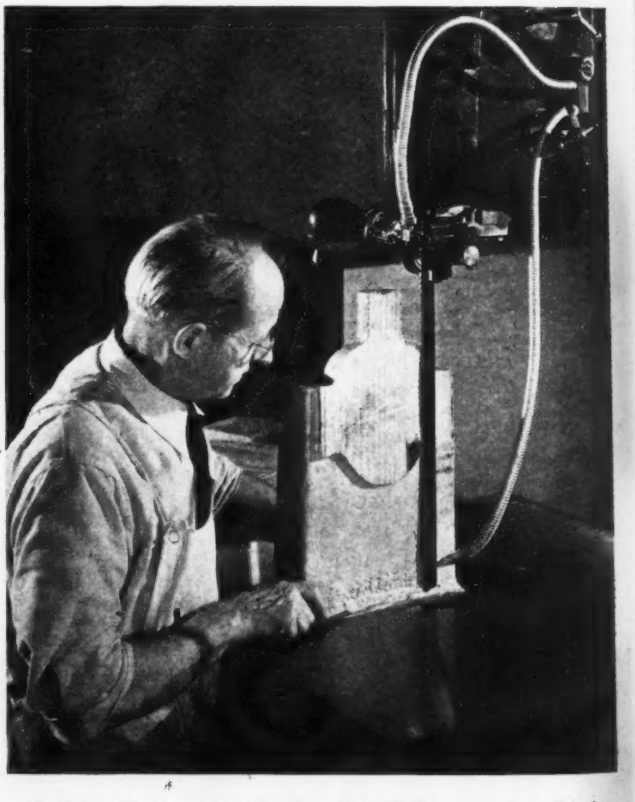
"Certified Accuracy" Micrometers Made by Central Tool Co.

## Central "Certified Accuracy" Micrometers

The Central Tool Co., Auburn, R. I., is placing on the market a new line of "Certified Accuracy" micrometers. The new enamel-finish micrometers in this line are made in sizes from 1 to 6 inches, and are available at prices considerably lower than the polished-frame type. The frames of these micrometers are drop-forged of



Sheffield Height Indicator with "Electrigage"



Machine Equipped with New DoAll Buttress Saw Blade



To obtain additional information on equipment described on this page, see lower part of page 200.

# BONDED

Chicago

It's the new bond that gives the ultra smooth finishes you get with Chicago Grinding Wheels—

Precision finishes undreamed of before—

Finishes so accurate that you can measure them in micro inches with a Surface Analyzer.

Whatever you have to finish—metals, alloys, plastics, wood, laminates or composition materials—you can do it better with Chicago Wheels.

Chicago Wheels have kept pace with the precision requirements of our war industries, and you can use them with confidence to finish civilian goods better in double quick time.

### CHICAGO GRINDING WHEELS

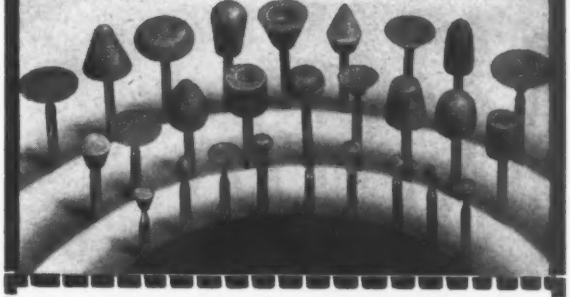
A wide range of grains and grades and—for the duration—sizes up to 3" in diameter.

### CHICAGO MOUNTED WHEELS

The first made and the finest today. In a selection of bonds, abrasives and shapes to handle each job more efficiently.

### TRY ONE FREE

We'll send without charge a Mounted Wheel or an FV Bond Grinding Wheel. Tell us size you'd like.



*Write for Catalog listing all Chicago products and showing comparative photographs of finishes with different kinds of Wheels.*

**CHICAGO WHEEL & MFG. CO.**

*Headquarters for Mounted Wheels and Small Grinding Wheels*

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*Half a Century of Specialization has established our Reputation as the Small Wheel People of the Abrasive Industry.

Send Catalog. Interested in MR-10

☐ Mounted Wheels. ☐ Grinding Wheels.

☐ Send Test Wheel. Size.....

Name.....

Address.....

special alloy steel, and have permanent non-corrosive black baked-enamel finish.

The improved forged-steel, polished-frame micrometers with decimal equivalents are available in 1- and 2-inch sizes. Micrometers with ratchet stops, lock-nuts, and 0.0001-inch graduations, as well as a full range of metric system micrometers, are available. .....75

## "Delta-Milwaukee" Bench Center

The Delta Mfg. Co., 620 E. Vienna Ave., Milwaukee 1, Wis., has placed on the market a new bench center known as the Delta-Milwaukee, designed to speed up inspection. An outstanding feature of this unit is the bracket, which can be firmly and quickly locked in any position on the bed by merely operating a conveniently located handle. The part that holds the indicator can be placed in either a vertical or a horizontal position. Large convenient clamp handles are provided to eliminate the necessity for using pliers or a wrench for clamping the indicator or other part in place.

The bench center bed consists of a heavy casting, fully normalized to relieve strains. The top surface is flat and the headstock and tailstock can be reversed to permit operating the unit from either side. Both stocks contain hardened and ground 60-degree angle centers for holding the piece to be inspected. This bench center has a maximum distance between centers of 19 1/2 inches, an over-all bed length of 32 inches, and a width of 5 1/2 inches. The dimensions of the ground surface of the bed are 4 1/2 by 30 inches.....76

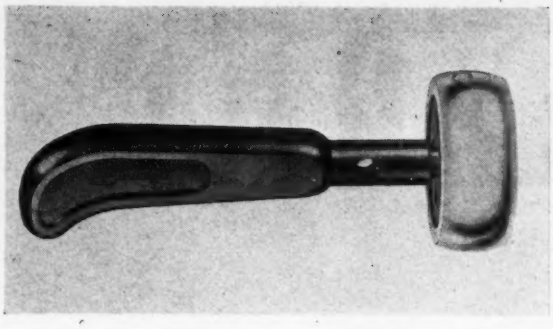


Fig. 1. "TeBo" Bore Gage with Spherical Head Brought out by the Standard Gage Co., Inc.

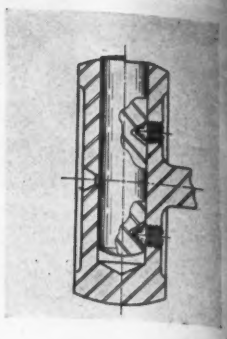


Fig. 2. Cross-section View, Showing Inset in "TeBo" Gage

## Improved "TeBo" Bore Gages

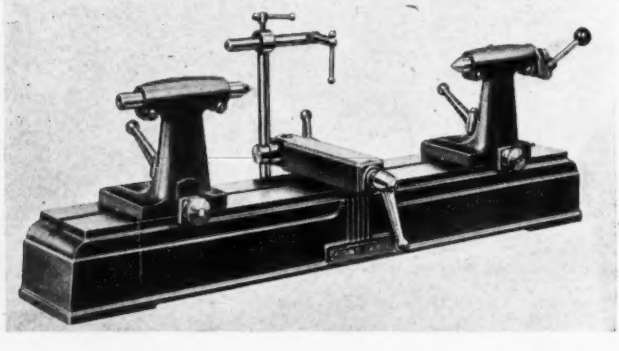
The Standard Gage Co., Inc., Poughkeepsie, N. Y., has recently commenced production of "TeBo" bore gages, for which it is the sole licensee in this country. The advantages claimed for these gages are ease of operation, accuracy, and speed. The gaging head is essentially a section of a sphere having a protective plating of hard chromium, which retains the high degree of accuracy of the gages over exceptionally long periods of service, more than 50,000 gagings with a single tool having been recorded.

The spherical head makes it possible to insert and withdraw the gaging head, in checking bores, with practically no effort. It also eliminates the possibility of the gage becoming jammed within the bore. On the periphery of the spherical head is a smaller projecting member, the contact portion of which is also spherical. This projecting member can be adjusted to the limit of maximum tolerance or to compensate for wear. Adjustment is effected by two tapered screws acting against the inset in a V-groove. By adjusting these screws, the "No Go" range can be increased or decreased within the dimensional limits of the gage.

The handle of the gage is precisely balanced to suit the weight of the head. Its position, as well as the feel of the gage, indicates the internal condition of the bore even to relatively inexperienced inspectors. If the gage is properly handled, it can be used for bores in aluminum or cast iron with as satisfactory results as for bores in hardened metal. The handles of the gage are insulated, so that heat from the inspector's hand will not expand the gaging head. .....77

## Briggs Clarifier for Cutting Oils

The Briggs Clarifier Co., 1339 Wisconsin Ave., N.W., Washington 7, D. C., has recently added to its standard line a new ZR series of clarifiers designed for the continuous filtration of soluble oils, low-viscosity cutting oils, and kerosene used in precision grinding,



Delta-Milwaukee Bench Center Made by the Delta Mfg. Co.

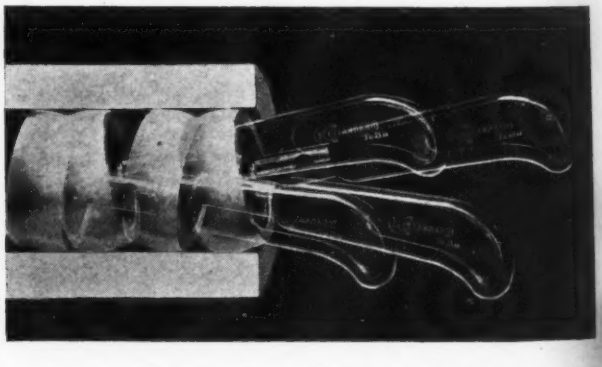
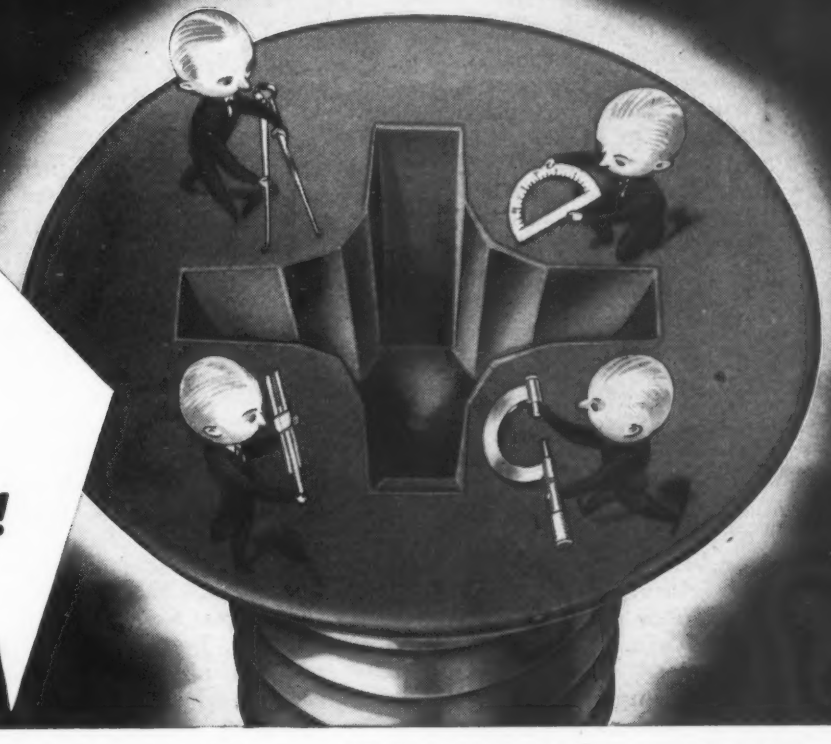


Fig. 3. Phantom View Illustrating Use of Gage Shown in Fig. 1



To obtain additional information on equipment described on this page, see lower part of page 200.

# IT TAKES A LOT OF *know-how* TO DESIGN AN *Engineered* SCREW RECESS



## . . . . . AND THE PHILLIPS RECESS HAS WHAT IT TAKES!

**TAKE A LOOK** at the center corners of the Phillips Recess above – and get a picture of some real screw engineering!

**THESE CORNERS** *aren't square!* They're rounded into a series of 16 flat planes. It's these flat planes that *hold* drivers in the Phillips Recess so well.

**THEN NOTICE** how the 4 wings and the 16 flat planes are angled. It's the scientifically determined degree of these angles that eliminates fumbling starts . . . makes it possible to use full turning power . . . makes it hard to burr Phillips Head Screws, and reduces wear on Phillips Bits and Drivers.

**FOR ANOTHER INSTANCE** of Phillips engineering ingenuity, note the depth of the Phillips Recess. It's not too deep . . . not too shallow. It's just the right depth to give Phillips Recessed Head Screws the strength to stand up under the heaviest driving pressures. Just the right depth to give maximum turning power with a minimum of effort . . . to keep drivers in proper alignment with screws!

**COST LESS!** Switch to screws with the scientifically engineered Phillips Recess — they cost less because they help you produce more! Available in any head style, type, or size.

# PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

## TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

**Faster Starting:** Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

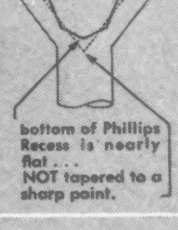
**Faster Driving:** Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

**Easier Driving:** Turning power is fully utilized. Workers maintain speed without tiring.

**Better Fastening:** Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

**IDENTIFY IT!**

Center corners of Phillips Recess are rounded . . . NOT square.



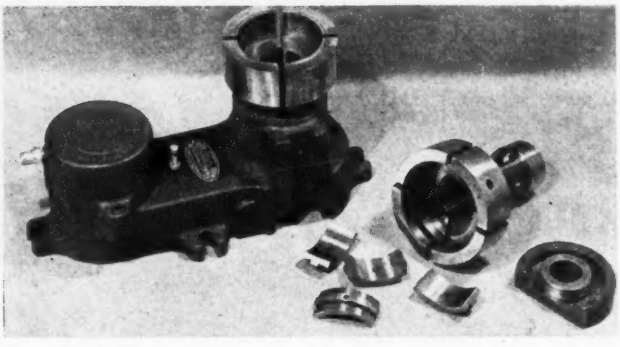
bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

## 24 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoli Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Wolverine Bolt Co., Detroit, Mich.

honing, light broaching, milling, and lathe work. It is claimed that grinders and honing machines equipped with this filter are able to maintain accuracy in size with tolerances as low as 0.00002 inch and produce work having a surface roughness (finish) as low as 3 micro-inches.

Reports have shown that Briggs Series Z filters employed in one plant reduced rejections from 60 to 12 per cent. In another plant, the life of grinding wheels was increased from 24 to 175 hours. In still another plant, the normal coolant life of two to three days was increased to seven to ten days by using this filter.—78



Redmer No. 2 Special Air Chuck with Adapter Designed to Increase Capacity for Holding Work up to 4 Inches

## Redmer Air Chuck

The Redmer Air Devices Corporation, 601 W. Washington Blvd., Chicago 6, Ill., has developed an adapter for its No. 2 special air chuck to increase the work-holding capacity to 4 inches. The adapter can be applied to the chuck by simply removing the stop-rod and inserting the adapter block illustrated. The master collet is then screwed on this base block, which accurately centers the work and prevents it from moving longitudinally when the chuck is opened or closed. Thus, accurate positioning of the work, which is an important feature of the Redmer air chuck, is retained when the adapter is used.—81

## Tachometer for Set-Up and Maintenance Work

A new form of tachometer designed for general setting up, maintenance, and time-study work has been brought out by the Standard Machinery Co., Providence 7, R. I. This instrument weighs only 5 1/2 ounces, is 2 1/2 inches in diameter, and is adapted for one-hand manipulation. The recording in revolutions per minute is easily read without the use of any counting or timing device.

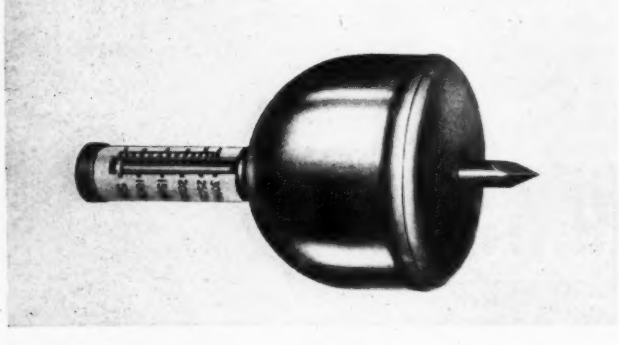
The range of this instrument is from 500 to 3600 R.P.M. Checking of stock models has shown a variation in the readings of less than 3 per cent from absolute accuracy over the whole speed range. Standard units have been subjected to 50,000 test readings without showing any variation in the accuracy of the readings recorded. A pointed contact spindle is furnished as part of the instrument for use with shafts having centers, and an elastic tip is provided which can be slipped over the pointed spindle for use on shafts without centers. The instrument is dust- and moisture-proof, and has a baked enamel protective coating.—79

## Single-Purpose Automatic Drilling Unit

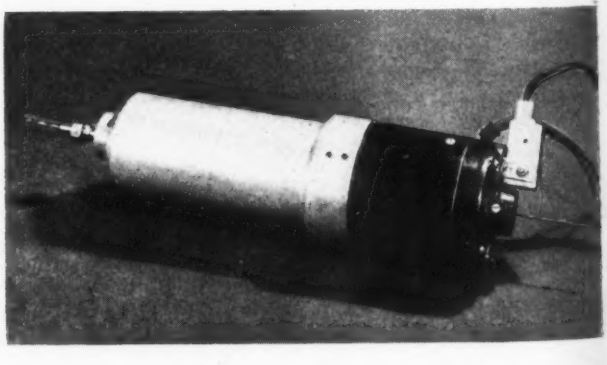
A new single-purpose automatic drilling unit has been developed by the Simplex Engineering Co., 14519 Schaffer, Detroit 27, Mich., and is being made in three models having capacities for using drills ranging from the No. 80 size up to 3/8 inch in diameter. This unit has been designed to meet the demand for a simple, dependable, single-purpose drilling unit. It is self-contained, and can be mounted at any angle or in any plane and operated automatically by electrical circuits, as desired. A number of these units can be mounted in a special machine to insure rapid drilling and reaming of parts on high production work.—80

## Controls for Resistance Welding Machines

A new precise electronic forge-pressure timer has been incorporated by the General Electric Co., Schenectady 5, N. Y., in the company's line of capacity discharge controls for use with stored-energy type resistance welding machines. The new timer, which is designed for dual-pressure spot-welding machines of the capacitor discharge type, functions to supply accurately timed forge-pressure, so that the required welding energy, cracks, indentations, and sheet separation are reduced. A feature of the new timer is that it is mounted on a small steel base so constructed that it can be added to any General Electric capacity discharge control already installed, provided the resis-



Tachometer for Recording Revolutions per Minute Made by Standard Machinery Co.

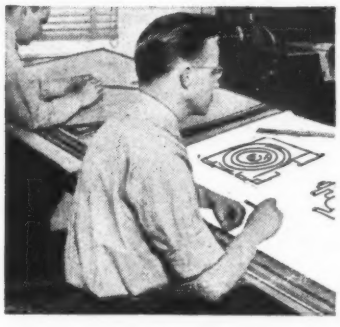


Simplex Single-purpose Automatic Drilling Unit Available in Three Sizes



To obtain additional information on equipment described on this page, see lower part of page 200.

# MAKE ALL OF THESE PRINTS FROM ANY DRAWING



**Black-line print**
**Blue-line print**
**Red-line print**
**Foil print**
**Dryphoto print**
**Black-line cloth**
**Sepia-line intermediate**

Ozalid Type 2600—$370 F.O.B.
Johnson City, N. Y.

**With an Ozalid Dry-Developing Machine** which you use with your present printer. First expose your drawing with the desired type of Ozalid paper. Then transfer the print to the OZALID DRY-DEVELOPER for quick processing.

**With an Ozalid Whiteprint Machine** which prints and dry-develops copies of your originals in seconds. No additional equipment necessary.

Ozalid Model F—$825 F.O.B.
Johnson City, N. Y.

## SAVE WITH THE ONLY COMPLETE PRINTMAKING PROCESS

When you adopt Ozalid, you have a versatility found in no other reproduction process—or combination of processes.

For only Ozalid offers you the advantages of Dry-development . . . with a complete line of sensitized materials that will inspire *new* applications in your plant, and promote savings on every side.

Here are just a few uses you'll find for the "OZALID VARIETY" which you can produce quickly in your machine—each print in the same manner.

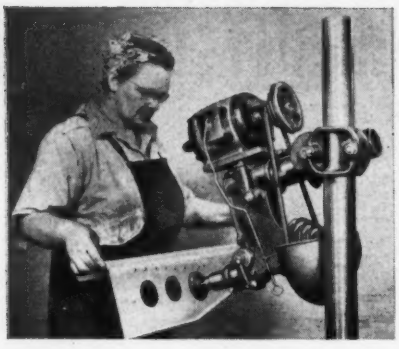
- **Use Ozalid red, black, blue line** prints to identify prints of different departments . . . to distinguish checked from unchecked prints, etc.
- **Use Ozalid Rapid Black** (new black line paper) to obtain exceptional facsimiles of typewritten material. When the original is good, the print will be still better. BESIDES OZALID PRINTS WON'T SMUDGE.
- **Use Ozalid intermediate** prints in place of original drawings to produce subsequent prints...to supply branch offices . . . to save valuable time when making design changes.
- **Use Ozalid Dryphoto Paper** to make beautiful reproductions from photographic film-positives... or perspective drawings.
- **Use Ozalid cloth** when prints of exceptional strength are desired.
- **Use Ozalid transparent foils** to:
  1. Produce extremely fast-printing intermediates
  2. Make composite prints
  3. Reclaim worn or damaged drawings

**See** all these prints yourself. *ALSO* learn the complete OZALID story. Write for free booklet of Ozalid Whiteprints and Catalogue today.

# OZALID

**Division of General Aniline and Film Corporation**
**Johnson City, New York**

**Ozalid in Canada—Hughes-Owens Co., Ltd., Montreal**



Drill Press Spindle Located in Convenient Working Position by Nobur Angle Bracket

tance welding machine has a dual-pressure system designed for this purpose. ..... 82

## Zagar Collets and Collet Pads

Zagar Tool, Inc., 23886 Lakeland Blvd., Cleveland 17, Ohio, has recently added several collets and collet pads of the design shown to its line of work-holding and indexing fixtures. These additions include a 5-C draw type and a No. 2 W & S type, as well as No. 6 W & S type master collet. Both types of collets and pads for master collets can be furnished for holding round, hexagonal, or square stock. These collets are precision-made, and are hardened and ground throughout. The 5-C draw collets have ground threads to insure accuracy. ..... 83

## Nobur Angle Bracket for Drilling Machines

The Nobur Mfg. Co., 910 N. Orange Drive, Los Angeles 38, Calif., has developed an angle bracket designed to convert any drill press into a versatile machine for performing such operations as angle drilling, polishing, buffing, sanding, rotary filing, wire brushing, tapping, reaming, burring, grinding, and honing. According to the manufacturer, this new angle bracket provides a quick and inexpensive means for handling hundreds of tedious jobs that demand speed and efficiency. The spindle can be adjusted to any height, located horizontally or vertically or at any angle, and can be set at any angle as required for the most convenient operation.

The angle bracket is available for use on practically all kinds of drill presses having round tubular columns ranging from 2 3/4 to 3 29/32 inches in diameter. It is rigidly constructed, positive locking, and can be easily clamped in any position by a wrench. ..... 84

## Taper Attachment for Lathes

A taper attachment of simplified design has been placed on the market by the Master-Taper Co., 126 N. Clinton St., Chicago 6, Ill. This new attachment is designed for accurate taper turning, boring, and threading operations on the lathe.

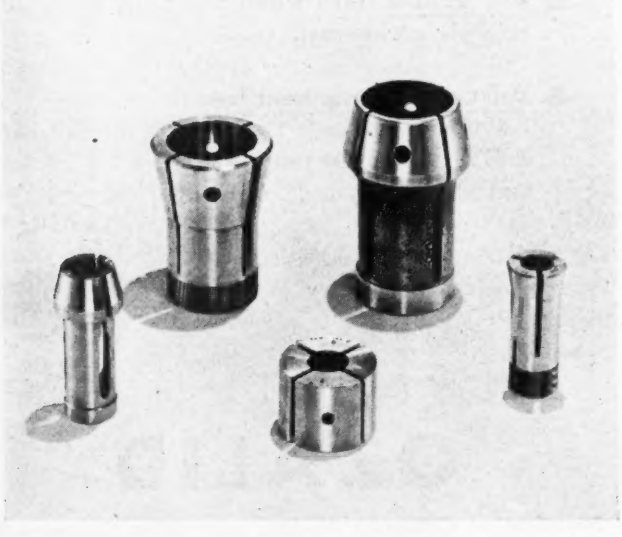
Taper Attachment for Lathes Made by Master-Taper Co.

The sliding fixture has straight gibs designed to eliminate vibration and tool play. Taper graduations in inches per foot are given at one end of the swivel bar and in degrees at the other end.

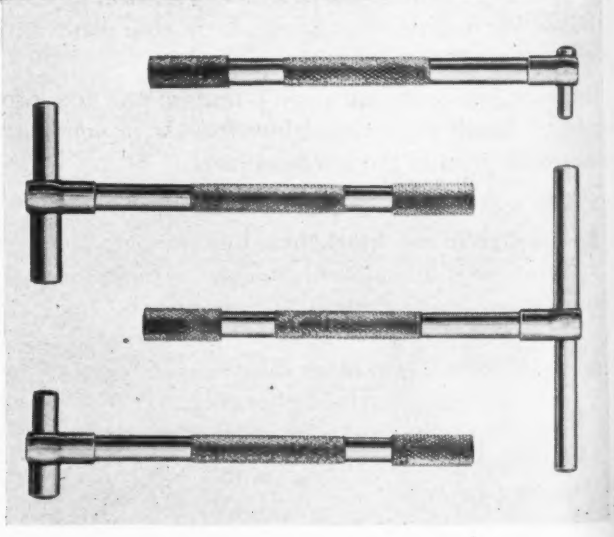
Settings can be made for machining tapers up to 3 1/2 inches per foot or 16 1/2 degrees maximum in either direction for a length of 7 1/2 inches at one setting. The device can also be used for accurate duplication of tapered parts on a production basis. It can be quickly attached to or removed from the lathe. Sturdy construction, with provision for adjustments to compensate for wear, assures long life. ..... 85

## Brand Telescoping Gages

The Brand Tool & Supply Co., 500 W. Washington Blvd., Los Angeles 15, Calif., has brought



Collets and Collet Pads Added to the Line of Zagar Tool, Inc.



Telescoping Gages Brought out by the Brand Tool & Supply Co.



To obtain additional information on equipment described on this page, see lower part of page 200.

# What you want to know about Broaching

**Answers to most questions on broaching methods and applications have been prepared by Colonial Broach Company, Detroit. Your copies are now available upon request on your company letterhead. Here are some of the printed bulletins now ready for mailing.**

**Ask for them by Bulletin Number.**


**colonial BROACH COMPANY**
DETROIT 13, U.S.A.
*Broaches — Broaching Machines - Broaching Equipment*

*Available soon —*

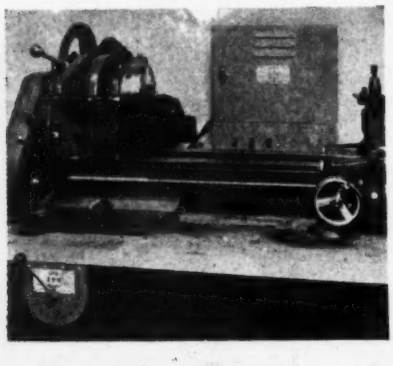
The most complete manual on broaching and catalog of broaching equipment ever published. Reserve your copy now.

out a line of hardened and ground telescoping gages in four sizes—5/16 to 1/2, 1/2 to 3/4, 3/4 to 1 1/4, and 1 1/4 to 2 1/8 inches. They can be had in sets of three gages from 1/2 inch to 2 1/8 inches or in sets of four gages from 5/16 inch to 2 1/8 inches, each set being enclosed in a leatherette case. ..... 86

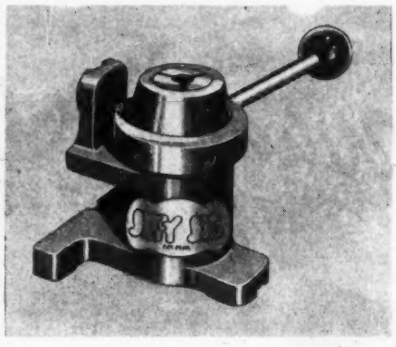
## Junior and Midget Varitronic Speed Controls for Small Motors

The Electron Equipment Corporation, South Pasadena, Calif., has recently added two new electronic speed controls to its line of electric motor speed-varying equipment. The Junior Varitronic control can be easily applied to any lathe drive of 1/4, 1/2, or 3/4 H.P. It can be furnished in standard, remote control, and portable types, which will accomplish for the small bench lathe what the Senior Varitronic motor control does for heavier machine tools. Stepless speed control over a wide range is provided in either direction by simply manipulating the conveniently located lever on the remote control.

The Midget Varitronic control, which has also been brought out by this company, is somewhat smaller than the Junior model, being made in 1/6- and 1/8-H.P. sizes for use in regulating the speeds of motors employed to drive blowers, high-speed portable tools, and office equipment. This control measures only 5 by 10 by 8 inches, and is the smallest complete electronic motor control unit brought out by the company. The speed ratio may be as high as 200 to 1 with high torque at all speeds. ..... 87



Lathe Equipped with Varitronic Speed Control



Monarch Lever-operated Collet Chuck

## Lever-Operated Collet Chuck

A new lever-operated chuck, known as "Jiffy Jig Model J-10," which has a capacity for holding stock ranging from 1/16 to 1 inch in cross-section, has been announced to the trade by the Monarch Governor Co., 1832 W. Bethune, Detroit 6, Mich. This chuck can be readily adapted to various machine tools for use in drilling, milling, boring, grinding, and similar operations. Provision is made for setting it up in either the horizontal or the vertical position. It has been designed to provide ample chip clearance. There is no axial movement of the collet when the chuck is opened or closed. The latter feature assures positive axial dimension control over the work.

The Jiffy Jig consists essentially of three parts—a cap, base, and an operating lever, the taper on the cap conforming to that of the collet. With the proper sized collet in place, the cap is screwed down on the base until the collet opens and closes as desired. The threaded operating lever can then be attached in the most convenient location. This chuck can also be used in conjunction with an automatic spring ejector. ..... 88

## Stellite Thread Plug Gages

The Cadillac Gage Co., 20316 Hoover Ave., Detroit, Mich., has recently increased its production facilities and is now making all standard sizes of Stellite thread plug gages from No. 6 up to 15 inches in diameter. Gages of special pitch diameters can also be furnished to customers' specifications. The company also manufactures steel thread plug and thread ring gages in a complete range of sizes.

It is claimed that Stellite plug gages developed by this company and tested over a period of three years have been found to reduce gage costs by as much as from 50 to 85 per cent. The advantages claimed for Stellite gages include lower coefficient of friction and much greater resistance to wear. Being acid- and corrosion-proof, the Stellite gages are not impaired by moisture or other corrosive agents. They are non-magnetic, and have less tendency to seize when gaging close fits. ..... 89

* * *

## Bristol Time-Program Potentiometer Controller

What is known as a time-program control has been made available by the Bristol Co., Waterbury 91, Conn., for the company's Model 431 Pyromaster potentiometer pyrometer. These controllers automatically regulate temperature—not necessarily at a fixed point, but through a predetermined series of changing values. Blank metal cams with time and temperature graduations printed on the face enable the user to cut out his own cams with a pair of tin snips.

The controlling device has a range up to 3000 degrees F. for thermo-couple type controllers, and up to 3600 degrees F. when used in connection with the company's compensated radiation unit.

* * *

## Tool Steels Cast to Shape

Tool-steel parts are now being cast to shape for commercial applications by the Cast-to-Shape Division of the Jessop Steel Co., Washington, Pa. These cast-to-shape tool-steel parts are used for dies, forming tools, glass molds, gages, hobs, gears, cams, and many other items. It is obvious that, in casting to shape, there is a pronounced saving in time, labor, material, and machining costs. All castings are furnished in the annealed condition, so that they can be machined when required. These tool-steel castings are regularly being made from air-hardening, oil-hardening, flame-hardening, stainless, and heat-resistant steels. Steels to special analysis can also be cast to shape if required.



To obtain additional information on equipment described on this page, see lower part of page 200.

# How to eliminate C-H-A-T-T-E-R and JERK from hydraulic controls

When hydraulically operated machines no longer run smoothly . . . when you have trouble getting close finishing cuts . . . if platen heat thins out oil in your presses—those are times when you must look into the oil medium being used.

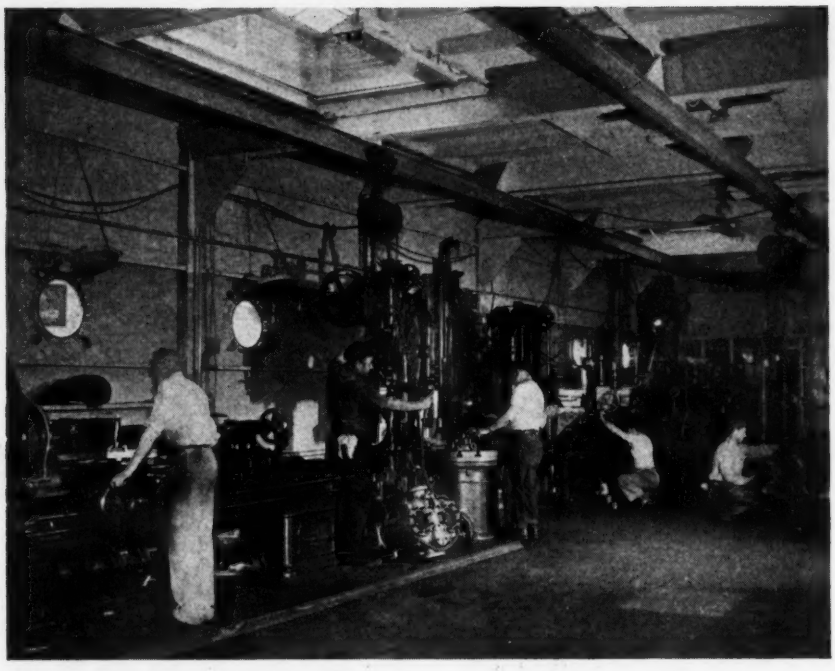
*Hydro-Drive* Hydraulic Oil today is helping thousands of machine tools to operate faster and more accurately. Houghton's unique patented processing of this oil results in these three principal merits—

1. Greatly improved oxidation stability, increasing its resistance to effects of pressure, heat, moisture and agitation.
2. Unusual solvent ability, which prevents deposition of gum and sludge on pumps, control valves, filters and other working parts.
3. A tough lubricating film, three times stronger than that provided by ordinary hydraulic oils.

As the owner or operator of hydraulically controlled machines, you can learn with profit how Hydro-Drive can help you. Write for 12-page illustrated booklet.

**E. F. HOUGHTON & CO.**
303 West Lehigh Avenue
Philadelphia 33, Pa.

*Houghton's*
# HYDRO-DRIVE



## Floating Machine Shop for New York Harbor

A unique floating machine shop for marine repairs, designed to help the war shipping effort by bringing the shop to the ship instead of the ship to the shop, has just gone into service in New York harbor. The floating machine shop was designed and built by the Zalud Mobile Marine Corporation, Stapleton, Staten Island. It is 105 feet long by 36 feet wide. It will be towed to the aid of ships lying in the harbor, and is capable of handling any general or voyage repairs to ships, eliminating the necessity of trucking parts and materials to remote parts of the port and saving many a costly delay.

The equipment includes an electric generating plant, powered by two Diesel engines and capable of lighting and operating the auxiliaries of vessels to be repaired should their own machinery be inoperative. Special pumping equipment is also provided. The machine shop equipment is installed on a working floor of over 3000 square feet, and includes lathes of various sizes, a milling machine, boring mills, shapers, drilling machines, and a power hacksaw, as well as welding and flame-cutting equipment. There is also 2000 square feet of storage space for materials, tools, etc. In a deck house above the working floor, living quarters are provided for a maintenance crew, including sleeping quarters and a fully equipped office. The working floor is thoroughly lighted by fluorescent lights, and outdoor floodlights are provided for night work on ships to be repaired.

## Automatic Marking Machine

An automatic unit known as the "Markomatic," which can be attached to any type of conveyor, or to filling, wrapping, packing, extruding, or laminating machines, and which automatically marks either the product, its wrapping, or its container, has been developed by Adolph Gottscho, Inc., 190 Duane St., New York 13, N. Y.

This device can be used to automatically mark control numbers, dates, identifications, part numbers, brands, weights, lot numbers, etc. The device is said to be easy to attach and remove, so that it can be used for different purposes in the plant. The imprinting medium may be a rubber die, or rubber, steel, or brass type. The objects to be marked need not be stopped, provided they are traveling at a speed of 10 feet per minute or less. The part to be marked, itself, trips the switch controlling the marking die.

## Tooling Guide for Turret Lathe Operators

A tooling guide book entitled "How to Machine Parts on Turret Lathes" has just been issued by the Operators' Service Bureau of the Warner & Swasey Co., Cleveland, Ohio. The guide book, which gives specific directions for performing all types of turret lathe work, is the fifth step in a program of operator education inaugurated by the company four years ago. The first of these steps was a monthly publication entitled "Blue Chips," which described specific turret lathe jobs. The second step was the publication in 1940 of a 240-page textbook—a complete operator's manual.

The third step consisted of an illustrated lecture, "Ten Ways to Get Better Results," which has been presented personally by Warner & Swasey engineers in 950 plants. Then, in 1942, came the fourth step—a sound motion picture entitled "Chips," showing turret lathe operators just what happens when the cutter is improperly ground or incorrectly set. This film has been shown to over 80,000 turret lathe operators throughout the country. The present tooling guide book has been designed to help solve the training problems that will arise in connection with post-war reconversion.

The tooling guide book, as well as the other material prepared by the Operators' Service Bureau, is available to all turret lathe operators, regardless of whether or not they work on Warner & Swasey machines. To operators, the price of the book is 50 cents per copy; to others, it is $1 a copy.

* * *

## Motion Picture on Tracer-Controlled Milling

The George Gorton Machine Co., of Racine, Wis., has brought out a new thirty-minute motion picture in color and sound entitled, "Exact Duplicate." The film shows many new techniques in tracer-controlled milling, engraving, etching, and duplicating. It is available without charge for showing at meetings of technical societies, company groups, etc. Further information can be obtained from the company.

# MACHINERY'S DATA SHEETS 523 and 524

## CARBIDE GRADES FOR CUTTING DIFFERENT MATERIALS

| Material to be Cut | Carbide Grade Designations | | | | | |
|---|---|---|---|---|---|---|
| | Allegheny Ludlum | Carboloy | Firthite | Jessop Steel Co. | Kenna-metal | Vascoloy Ramet |
| Alloys—Copper, Aluminum, Brass, Bronze, etc. | CA4 | 883 | HA | MF | K6 | 2A5 |
| Cast Iron | | | | | | |
| Soft, Hard, and Chilled | | | | | | |
| Continuous Cut, Roughing | CA3 | 883 | HA | MF | K6 | 2A5 |
| Finishing | CA4 | 883 | HA | MF | K6 | 2A5 |
| Soft and Hard, Intermittent Cut | CA3 | 44-A | HC | DC | K6 or K2S | 2A3 |
| Insulation | | | | | | |
| Micalex | CA4 | 883 | HA | MF | K6 | 2A5 |
| Micalex Molded to Steel | CA4 | 883 | HA | MF | K6 | 2A5 |
| Micarta, General Machining | CA4 | 883 | HF | MF | K6 | 2A7 |
| Micarta, Precision Boring | CA4 | 905 | HA | MF | K6 | 2A7 |
| Other Insulation, Paper, etc. | CA4 | 905 | HA | MF | K6 | 2A7 |
| Steel | | | | | | |
| Rolled or Forged, Continuous Cut | CA1 | 78 | TA | SF | KM or K3H | E |
| Heat-treated, Heavy Continuous Cut | CA1 | 78-B | T-89 | SF | KM | EM |
| Heat-treated, Light Continuous Cut | CA2 | 78-B | T-16 | SF | K3H | EM |
| Cast, Heavy Continuous Cut | CA1 | 78-B | T-89 | SF | K2S | EM |
| Cast, Light Continuous Cut | CA2 | 78-B | T-16 | SF | K3H | EM |
| Cast or Rolled, Intermittent Cut | CA1 | 78-C | T-04 | CR | KM | EE |
| Wear Resistance, Carbides for | .... | 883 | T-41 | MF | K6 | 2A5 |

**MACHINERY'S Data Sheet No. 523, October, 1944** — Compiled by MACHINERY from Data Obtained from Users and Manufacturers of Carbide Tool Materials

## RECOMMENDED TAPPING SPEEDS AND LUBRICANTS

### Tapping Speeds

| Material to be Tapped | Speed, in Feet Per Minute | |
|---|---|---|
| | Carbon Steel Taps | High-Speed Steel Taps |
| Allegheny Metal | * | 15–25 |
| Aluminum | 45–50 | 90–100 |
| Bakelite | * | 60–70 |
| Brass | 45–50 | 90–100 |
| Bronze | 20–30 | 40–60 |
| Bronze-Manganese | * | 30–40 |
| Copper | 45–50 | 90–100 |
| Die-Castings | 30–35 | 60–70 |
| Duralumin | 45–50 | 90–100 |
| Fiber | * | 80–90 |
| Iron (Cast) | * | 70–80 |
| Iron (Malleable) | * | 35–60 |
| Monel Metal | * | 20–25 |
| Nickel Silver | * | 75–85 |
| Rubber (Hard) | * | 80–90 |
| Steel, Cast | * | 20–30 |
| Chromium | * | 20–30 |
| Machinery | 20–30 | 40–60 |
| Manganese | * | 10–15 |
| Molybdenum | * | 20–30 |
| Nickel | * | 25–35 |
| Stainless | * | 15–25 |
| Tool | 15–20 | 25–35 |
| Tungsten | * | 20–30 |
| Vanadium | * | 25–35 |

*Carbon steel taps are not recommended.

### Lubricants

| Material to be Tapped | Kind of Lubricant |
|---|---|
| Cast Brass or Bronze | Light mineral or soluble oil |
| Forged Brass or Copper | Mineral with lard base |
| Cast Iron | Light mineral or soluble oil |
| Aluminum, Aluminum Alloys, etc. | Add kerosene to light mineral oils, and sometimes also add good lard oil |
| Alloy Steel, Low-Carbon Steel Forgings | Good grade of sulphur-base oil |
| Magnesium Alloys | Dry or mixture of 10 per cent lard oil and 90 per cent light mineral oil diluted with 30-40 per cent kerosene |
| Stainless Steels | Soluble oil with sulphur added. On tough jobs, use paste of white lead and a high sulphur-base lard oil |
| Beryllium Copper | Lard oil |
| Nickel Silvers and Cupro-Nickels | Sulphur-base oil |
| Aluminum Bronze | 1/3 kerosene and 2/3 lard oil |
| Copper-Silicon Alloys | Kerosene and lard oil mixture |
| Laminated Plastics | Dry or water |
| Hard Rubber | Any good grade tapping oil |
| S A E Nickel Alloy Steels | Sulphurized mineral oil |
| Carbon Sheet Steel | Sulphur-base oil |
| Nitriding Steels | Sulphurized mineral oil |
| High-Nickel Alloys | Sulphurized mineral lard oil |

**MACHINERY'S Data Sheet No. 524, October, 1944** — Compiled by Threadwell Tap & Die Co., Greenfield, Mass.

# News of the Industry

## California and Oregon

DEMCO TOOL SERVICE, INC., 5236 San Fernando Road, Glendale, Calif., has been organized by a group of Detroit machine tool and cutting tool manufacturers to provide complete field engineering service on gear production, broaching, tapping, thread milling, and all forms of general machining, including the use of both high-speed steel and carbide cutting tools. In addition, the company will provide tool reconditioning services and is equipped to handle job broaching. The companies represented by the new organization include MICHIGAN TOOL CO., COLONIAL BROACH CO., DETROIT TAP & TOOL CO., TUNGSTEN CARBIDE TOOL CO., COLONIAL BUSHINGS, INC., and NEW METHOD STEEL STAMPS, INC., all of Detroit, Mich., as well as the GENESEE TOOL CO., of Fenton, Mich. The head of the new company is RUSSELL W. LUZIUS.

CAPTAIN E. D. ALMY, assistant general manager of the Joshua Hendy Iron Works, Sunnyvale, Calif., has been advanced to the position of manager of the Crocker-Wheeler Division of the organization at Ampere, N. J. A. J. M. BAKER, who previously held the latter position, has resigned to become executive vice-president and general manager of the E. W. Bliss Co., with headquarters in New York. HARRY C. GUNETTI succeeds Captain Almy as assistant general manager in Sunnyvale. He has held the position of general superintendent for more than three years, and will be succeeded in that position by ROBERT MANN, formerly assistant general superintendent. CLIFFORD SAYRE becomes assistant general superintendent.

MOORE MACHINERY CO., 3878 Santa Fe Ave., Los Angeles 11, Calif., has been appointed exclusive representative for the line of Reed-Prentice high-pressure die-casting machines for zinc, aluminum, and other alloys, as well as for the Reed-Prentice line of improved type plastic injection molding machines. The Moore Machinery Co. will handle service and engineering of these products in the Los Angeles area.

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Ave., Detroit 32, Mich., has appointed the GARRETT SUPPLY CO., 3844 S. Santa Fe, Los Angeles 11, Calif., distributor in the southern California and Arizona area for the carbide cutting tools and other products of the company.

GLOBE PRODUCTS MFG. CO., 3380 Robertson Blvd., Los Angeles, Calif., manufacturer of Globe millers and machine tools, has just purchased the entire machine tool line of the Utility Tool & Die Manufacturers, consisting of screw machines, turret lathes, cross-slides, beds, and turret and collet closers.

WALTER C. LAVERS, formerly stock clerk in the Los Angeles branch of Kennametal, Inc., Latrobe, Pa., has been advanced to the position of tool serviceman and representative at the same office.

DONALD FOSTER has recently been appointed Chicago branch manager of the Hyster Co., with offices in the LaSalle Wacker Bldg., 221 N. LaSalle St., Chicago. C. C. DUNHAM, formerly Chicago manager, becomes personnel manager at the Portland, Ore., plant of the company.

## Illinois and Indiana

ELBERT A. HOFFMAN and JOHN M. BIRDSONG have recently been added to the metallurgical engineering staff of the La Salle Steel Co., Chicago, Ill. Mr. Hoffman was formerly with the American Steel & Wire Co., and Mr. Birdsong was previously connected with the General Electric Co. RUSSELL M. RICHARDSON has joined the sales department of the company, and will have headquarters in the Detroit office, located in the New Center Building. He was formerly a metallurgical engineer and sales representative for the American Steel & Wire Co. and for the Peninsular Grinding Wheel Co. in Cleveland and Detroit.

PRODUCT DESIGNERS is a recently formed organization of industrial designers and engineers, with offices at 230 N. Michigan Ave., Chicago, Ill. The new concern offers a complete service, including idea development, design, engineering, tooling, and packaging. It is headed by W. C. NICHOLS and JOSEPH PALMA, JR., who were previously associated in business as industrial designers under the name of Nichols & Palma. The new organization is a division of the Johnson Fare Box Co.

M. K. SAUNIER has been appointed representative in the Chicago area of the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., succeeding WALLACE A. STANLEY. Mr. Saunier's headquarters will be at 9 S. Kedzie Ave. in Chicago. Mr. Stanley, who has been with the company for the last seven and one-half years, returns to the headquarters office, where he will serve as special assistant to the field sales manager.

RAY C. BENDER has been made Chicago district sales manager for the Alloy Rods Co., York, Pa. Mr. Bender was previously welding supervisor and engineer with the Continental Foundry & Machine Co. in East Chicago, Ind. The Chicago district office of the Alloy Rods Co. is at 3548 Archer Ave., Chicago 9, Ill.

HAROLD C. OLSON has been appointed sales manager of the Torrington Co., Bantam Bearings Division, South Bend, Ind., and JOHN A. TOTH has been made assistant sales manager. Mr. Olson has

Harold C. Olson, New Sales Manager, Bantam Bearings Division, Torrington Co.

John A. Toth, Assistant Sales Manager of Bantam Bearings Division

been with the company since 1935, formerly serving as district representative in Milwaukee and Pittsburgh. He has been assistant sales manager since 1941. Mr. Toth has been with the company since 1929. He was special representative in the steel industry before his present appointment.

R. A. HARTMAN, for the last four years master mechanic for the Crosley Corporation, Cincinnati, Ohio, has joined the Kropp Forge Co. and the Kropp Forge Aviation Co., Chicago, Ill., as superintendent of the machine shop. From 1936 to 1940, Mr. Hartman conducted his own business—a designing and engineering service.

DAVIS & THOMPSON CO., 6411 W. Burnham St., Milwaukee 14, Wis., has appointed LUTHER & PEDERSEN, 565 W. Washington Blvd., Chicago 6, Ill., direct sales representatives of the company. Martin J. Luther and Carl S. Pedersen were formerly associated with the Monarch Machine Tool Co.

ENCO MFG. CO. announces the removal of its main office and plant to larger quarters at 4522 W. Fullerton Ave., Chicago 39, Ill. The company's eastern sales office has also been moved to 129 Crosby St., New York 12. N. Y.

## Michigan

A. CARL TIEDEMANN has been made executive vice-president and general manager of the Dockson Corporation, Detroit, Mich., manufacturer of oxy-acetylene welding and cutting apparatus and industrial head and eye protection equipment. Mr. Tiedemann was formerly connected with the War Department, Office of the Chief of Ordnance, in Detroit, serving as chief of the Parts and Supplies Branch of the Engineering and Manufacturing Division.

JOHN STEEL has become account executive on the staff of Florez, Phillips and Clark, marketing agency, Detroit, Mich. Mr. Steel is a specialist in the fields of radio and electronics, and also holds several patents on hydraulic equipment. He combines advertising and selling experience with his engineering background. At one time, he was advertising manager for the Weltronic Corporation.

WARREN INDUSTRIES, 26665 Mound Road, Warren, Mich., announce that the company is now manufacturing precision gages to customers' prints, in addition to its regular line of special cutting tools.

FRED J. WOOD, formerly connected with the Jessop Steel Co., of Washington, Pa., has just been appointed district manager of William Jessop & Sons, Inc., Detroit, Mich.

## New England

FRED L. CURTIS has been appointed manager of the sales engineering department of the Norton Co., Worcester, Mass. Mr. Curtis has been with the company for sixteen years, the last five of which he has served as abrasive engineer in Detroit. FRED W. GRANT has been appointed merchandising engineer for the company. He has been connected with the Norton organization for over thirty years, and has served as abrasive engineer in the Milwaukee territory for the last nineteen years. PAUL H. CARLSON succeeds Mr. Grant as abrasive engineer in Milwaukee, and E. C. WILLEY becomes abrasive engineer for the Moline, Ill., area, succeeding Mr. Carlson.

LEONARD S. HOBBS has been elected vice-president for engineering of the United Aircraft Corporation, East Hartford, Conn., and has also been appointed a member of the operating and policy committee. As vice-president for engineering, he will coordinate the engineering programs of the various divisions of the corporation and will also continue his direction of certain special power plant developments. In addition, he will have charge of the activities of the research division. WRIGHT A. PARKINS has been made engineering manager of the Pratt & Whitney Aircraft Division.

ALEXANDER S. KELLER was elected a vice-president of the Niles-Bement-Pond Co., West Hartford, Conn., at a recent meeting of the board of directors. Mr. Keller has been connected with the Niles-Bement-Pond Co. since 1931, when the company purchased the Keller Mechanical Engineering Corporation. He has been a member of the board of directors since 1934. Mr. Keller will devote the bulk of his time to the promotion of export sales as head of the Pratt & Whitney foreign sales department.

Alexander S. Keller, Newly Elected Vice-president of the Niles-Bement-Pond Co.

## New Jersey

RANSOME MACHINERY CO., Dunellen N. J., announces the appointment of the following distributors of Ransome welding positioning equipment: The Post Welding Supply Co., Birmingham, Ala.; Hobart Welder Sales & Service, Cleveland, Ohio; W. P. & R. S. Mars Co., Duluth, Minn.; American Machinery & Supply Co., Omaha, Neb.; Arcway Equipment Co., Pittsburgh and Philadelphia, Pa., Baltimore, Md., and Richmond, Va.; Hobart Sales Service Supplies, Buffalo and Syracuse, N. Y.; Peoria Welding Supply Co., Peoria, Ill.; Big Three Welding Equipment Co., San Antonio, Corpus Christi, Dallas, Houston, and Fort Worth, Tex.; Moline Welding Service, Moline, Ill.; Chicago Welding Sales Co., Chicago, Ill.; Victor Equipment Co., San Francisco, Fresno, Los Angeles, and San Diego, Calif.; Austin-Hastings Co., Inc., Cambridge and Worcester, Mass., and Hartford, Conn.; J. E. Raney & Co., Boston, Mass.; and Welding Engineering and Sales Co., New York City, Buffalo, and Syracuse, N. Y.

THOMAS BARTLETT has recently joined the staff of the Lawrance Aeronautical Corporation, Linden, N. J., as operations manager. He has been associated with the Curtiss-Wright Corporation at Buffalo, N. Y., since 1928, having held the position of general superintendent of tool planning and manufacturing.

OPTIMUS EQUIPMENT CO. has been organized at Matawan, N. J., to design and manufacture a line of equipment for metal washing, rinsing, pickling, tumbling, and drying operations. The company will be closely affiliated with the HANSON-VAN WINKLE-MUNNING CO., also of Matawan.

E. F. HOUGHTON & CO., Philadelphia, Pa., announces that its office for the metropolitan New York area, formerly at 421 Seventh Ave., New York City, has been combined with its office and warehouse at 135 Hoboken Ave., Jersey City 2, N. J.

E. H. CARMANY has been appointed vice-president in charge of eastern operations of the Wyckoff Steel Co., Pittsburgh, Pa. His headquarters will be at the company's Empire Works in Newark, N. J.

## New York

F. JEROME TONE, JR., has been appointed vice-president in charge of sales of the Carborundum Co., Niagara

Falls, N. Y. He was previously vice-president in charge of the Eastern Sales Division of the company. Mr. Tone succeeds senior vice-president CHARLES KNUPFER, who has been assigned to special sales and executive activities. Vice-president HENRY P. KIRCHNER has been placed in charge of production, and OTIS HUTCHINS has been named technical director in charge of research and process control and development.

F. B. HUFNAGEL has resigned as chairman of the board of directors and president of the Crucible Steel Co. of America, New York City, and has been succeeded in the chairmanship by W. P. SNYDER, JR. Mr. Hufnagel will continue as a director and will serve also in an executive advisory capacity. He has been associated with the company for more than twenty-four years. Mr. Snyder has been a director of the company since 1930 and chairman of its executive committee since July, 1942.

LEONARD KEBLER, president of the Ward Leonard Electric Co., Mount Vernon, N. Y., for forty years, became chairman of the board of directors—a newly created post—at a recent meeting. DAWSON J. BURNS, vice-president of the company since 1919, succeeds Mr. Kebler as president. ARTHUR A. BERARD has been promoted to the position of executive vice-president and general manager.

SAMUEL GAHAN has retired as teacher of machine shop practice at the Machine and Metal Trades High School, New York City. He intends to devote much of his leisure time to the advancement of vocational education, on which subject he expressed definite ideas in an article "What is Wrong with Machine Shop Training in Vocational Schools," published in MACHINERY some years ago.

R. C. WILSON has been appointed sales manager of the Buffalo Division of the Farrel-Birmingham Co., Inc., Ansonia, Conn. He will have charge of the sales of gears, gear units, flexible couplings, and related products. Mr. Wilson has been connected with the Farrel-Birmingham Co. since 1934, and has served as assistant to the sales manager for the last two years.

LITTLETON C. BARKLEY, manager of the New York office of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., has been appointed sales manager of the Manhattan mechanical rubber goods sales department. For the present, his office will be located at 120 Broadway, New York City.

GENERAL ELECTRIC Co., Schenectady, N. Y., has purchased a 155-acre plot of ground in Liverpool, N. Y., five miles from Syracuse. When necessary materials are released by the Government, a new plant will be built as headquarters for the company's electronics department.

CHARLES E. WILSON has been re-elected president of the General Electric Co., Schenectady, N. Y., following his resignation from the War Production Board. OWEN D. YOUNG and GERARD SWOPE, chairman of the board and president, respectively, have resigned those posts.

L. ARMITAGE ENGINEERING SERVICE, 119 W. 57th St., New York 19, N. Y., and 221 N. LaSalle St., Chicago 1, Ill., announces that the name of the company has been changed to the ARMITAGE CORPORATION. There is no change in management or activities.

GEORGE GORTON MACHINE Co., Racine, Wis., manufacturer of precision machine tools, has appointed RUSSELL, HOLBROOK & HENDERSON, INC., 292 Madison Ave., New York City, exclusive representative of the company for the New England territory.

JOHN B. GIRDLER, sales representative for the last four years of the Vanadium Corporation of America, has been appointed sales manager of the eastern district of the company, with headquarters at 420 Lexington Ave., New York 17, N. Y.

WILLIAM E. PENNINGTON has been appointed assistant general sales manager of the Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y. He has been associated with the sales department for many years in a supervisory capacity.

AMERICAN STANDARDS ASSOCIATION, formerly located at 29 W. 39th St., has now removed to larger quarters at Grand Central Terminal Office Bldg., 70 E. 45th St., New York 17, N. Y.

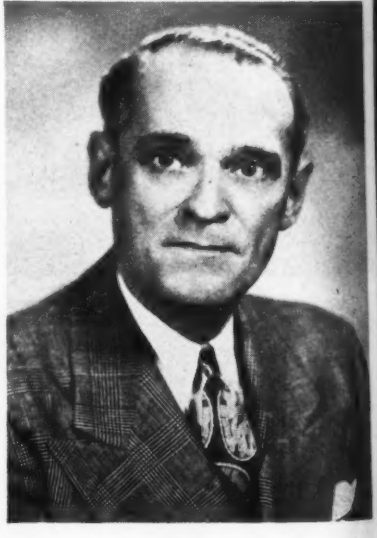
## Ohio

HOWARD C. SAUER has been appointed general manager of the newly created Foreign Division of the Timken Roller Bearing Co., Canton 6, Ohio. The new division will handle the sales and service of the companies products, including roller bearings, steel, and detachable rock bits, in the world market outside of the United States. The division's offices will be in Canton. Mr. Sauer was chief of the Anti-Friction Bearing Section of the Tools Division of the War Production Board from September, 1941 to September, 1944. He became connected with the Timken Roller Bearing Co. originally in 1923, and held the position of branch manager of the New York office when he was called to serve on the War Production Board.

M. M. Clark, Metallurgical Engineer with Climax Molybdenum Co. in Ohio District

M. M. CLARK has joined the Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y., as metallurgical engineer in the Ohio district. His headquarters will be at Room 1101, First National Bank Bldg., Canton, Ohio. Mr. Clark has had a wide experience in the steel industry, having previously been connected with the United Alloy Steel Corporation, Central Alloy Steel Corporation, and Carnegie-Illinois Steel Corporation.

EDWARD G. HARDIG has been promoted from the position of sales manager of the National Tool Co., Cleveland, Ohio, to the posts of vice-president in charge of sales and a director of the company. DOUGLAS C. ALBRIGHT has been appointed vice-president and assistant to the president.



Edward G. Hardig, Vice-president in Charge of Sales, National Tool Co.

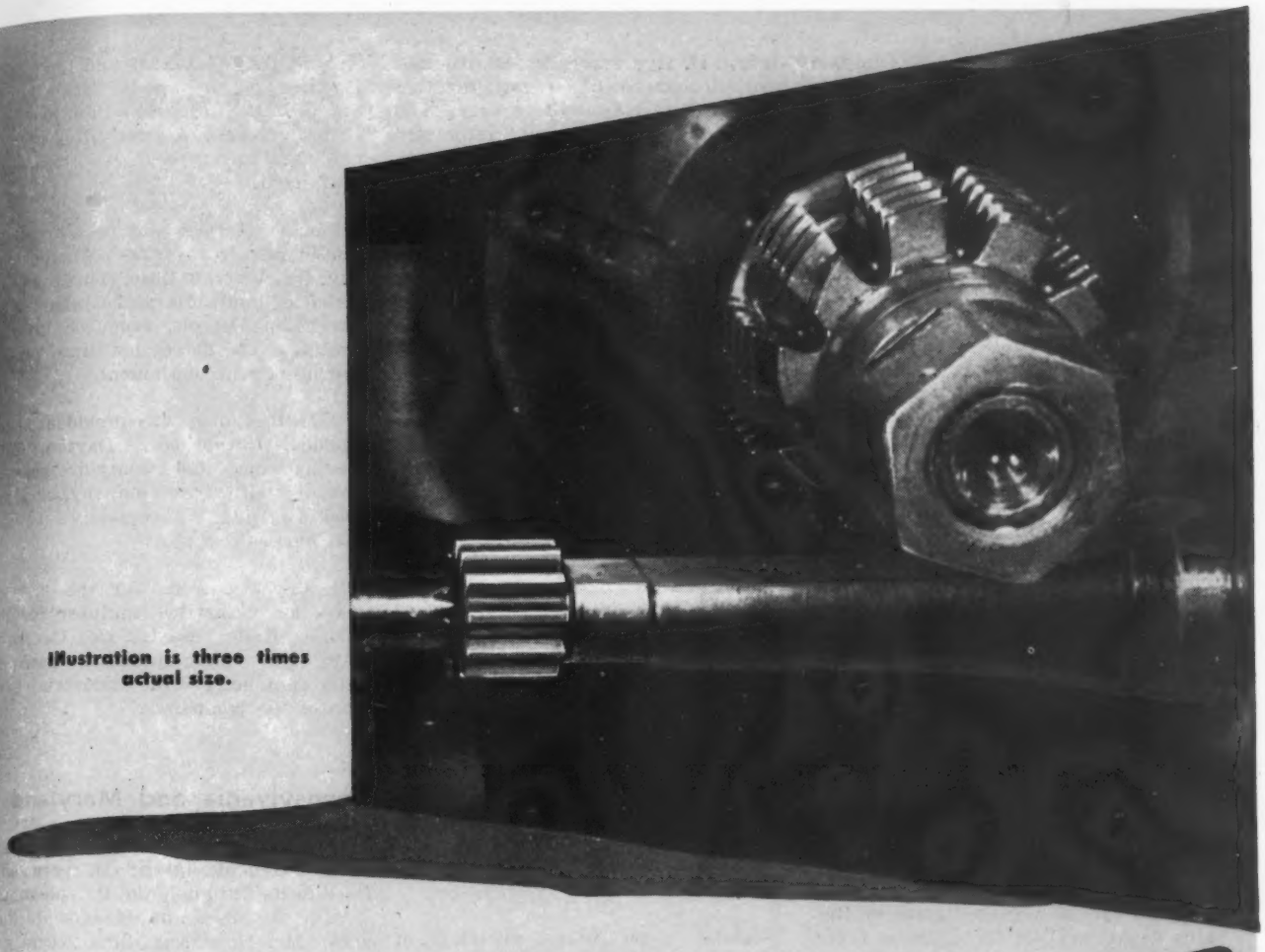


Illustration is three times actual size.

# 200 *fine pitch* GEARS PER HOUR with 2000 gears per hob sharpening

That's the sort of job Michigan fine-pitch ground hobs are designed to do. The gears are 48 pitch with 10 teeth, 7/32" long and an O.D. of 0.250 inch. Feed is automatic. On hand fed machines in the same plant, 50 *steel* gears per hour are being turned out with 750 gears per sharpening of the ground hob. The latter are 11 tooth, 48 pitch with an O.D. of 0.270. Both are used in supercharger controls.

Michigan fine-pitch hobs are available in ground form up to 48 pitch. Unground types can be furnished up to 96 pitch.

Where extreme precision is required, fine-pitch hobs for small gears can be furnished in pre-shave types, to enable finishing to almost any accuracy desired on Michigan 861-4B gear finishers.

*We will be glad to quote you on your requirements.*

ORIGINATORS of GEAR-SHAVING

## MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD • DETROIT 12, U. S. A.

BUY U.S. BONDS STAMPS

LEMPCO PRODUCTS, INC., 5489 Dunham Road, Bedford, Ohio, has purchased the CLEVELAND PRESSED STEEL CO., 2953 E. 55th St., Cleveland, Ohio. The new plant has been bought with the object of manufacturing a peacetime product which the company's experimental department has been developing for the last three and one-half years. The Cleveland Pressed Steel Co. will be operated under its present name and in the same location. GEORGE BRECK will continue as vice-president and general manager. HARRY HAYDEN, who has been with the company since 1914, has been promoted to the position of general factory manager.

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, announces that MILLS N. RIPLEY, formerly eastern district sales manager for the Bijur Lubricating Corporation, has been appointed sales manager of the new regional and branch office sales headquarters of the Hydraulic Press Mfg. Co. at 500 Fifth Ave., New York City. C. R. TERRY, previously executive assistant to the director of the WPB regional office in Cleveland, has been appointed sales manager of the new branch at 717-9 Hanna Bldg., Cleveland, Ohio.

VICTOR F. J. TLACK, long connected with the development of cobalt-chromium steels, has been appointed consultant and special representative of the sales department of the Latrobe Electric Steel Co., Latrobe, Pa. Until recently, Mr. Tlack served as president of Darwin & Milner, Inc., Cleveland, Ohio, with which firm he was associated for almost thirty years. He will make his headquarters at the Cleveland office of the Latrobe Electric Steel Co., 4516 Superior St.

H. CHURCH has been appointed vice-president in charge of sales of the Weatherhead Co., Cleveland, Ohio. GEORGE H. HUFFERD becomes vice-president in charge of engineering, and ROBERT P. GIBSON will serve as vice-president in charge of automotive sales. MORRIS H. WRIGHT has been appointed assistant to the president.

FRED R. COOPER has joined the executive staff of the Warren City Mfg. Co., Warren, Ohio. He was previously assistant to the president of Willys-Overland Motors, Inc., Toledo, Ohio. HARRY D. BEUTLICH has been made director of industrial relations for the company. He formerly held a similar position with Willys-Overland.

W. R. PERSONS, Pittsburgh district manager of the Lincoln Electric Co., Cleveland, Ohio, has been transferred to the main office and factory at Cleveland to carry out a special post-war planning assignment. Mr. Persons' post as manager of the Pittsburgh office will be filled by J. S. ROSCOE, formerly Syracuse district manager.

RALPH W. HISEY, vice-president of the Osborn Mfg. Co., Cleveland, Ohio, has been promoted to the position of vice-president in charge of all manufacturing and engineering of both the Brush and Machine Divisions of the company. HUGH M. LITTLE has been appointed works manager of both divisions.

GEORGE O. DESAUTELS, president of George O. Desautels Co. of Indianapolis, has been elected a member of the board of directors of the National Tool Co., Cleveland, Ohio, succeeding GORDON LEFEBVRE. The George O. Desautels Co. has represented the National Tool Co. in Indianapolis for the last eighteen years.

R. S. WHEELER, formerly with the Remington Arms Co., Inc., Bridgeport, Conn., has been appointed sales manager of the Machinery and Equipment Division of the Louis Berkman Co., Steubenville, Ohio. He will have charge of promoting sales activities of both new and used machine tools and equipment.

FRED O. KOLBERG has been appointed works manager of the Warren City Mfg. Co., Warren, Ohio. This company, which is a subsidiary of Graham-Paige Motors of Detroit, produces invasion landing craft, drives for cargo vessels and other war equipment.

C. H. REYNOLDS, vice-president of the Sheffield Corporation, Dayton, Ohio, has just completed twenty-five years of services with that company, and has been awarded the company's twenty-five-year service pin.

R. G. WINGERTER, for the last six years an industrial engineer for the Timken Roller Bearing Co., Canton 6, Ohio, has been appointed assistant chief engineer for the Industrial Division of the company.

## Pennsylvania and Maryland

KENNAMETAL INC., Latrobe, Pa., has added two field engineering representatives to its Philadelphia, Pa., personnel —PAUL A. HERR and HARRIS H. ROBBINS. Mr. Herr was until recently a partner in the Alfred Stauffer Machine Shops at Honey Brook, Pa., where he had charge of tooling operations. Mr. Robbins was connected for eight years with the St. Paul Hydraulic Hoist Co. in the capacity of machinist, methods engineer, and factory superintendent.

WILBUR C. OSHA, until recently general welding superintendent at the Berwick, Pa., plant of the American Car & Foundry Co., has been appointed general supervisor of welding for the company. In this capacity, he will have supervision over welding operations at all twelve of the company's plants. His headquarters will be at Berwick, Pa.

KRESTON T. SORENSEN, who joined the staff of William Sellers & Co., Philadelphia, Pa., less than a year ago, has been made vice-president in charge of production. Mr. Sorensen was recently in charge of the design of special secret ordnance weapons and material for the Ordnance Department, heading the engineering section located at the Franklin Institute.

ROBERT L. IRVIN has been appointed works manager of the Graham plant of the Pittsburgh Screw and Bolt Corporation, Pittsburgh, Pa., succeeding GEORGE H. LEE, SR., who will devote his entire time to experimental and advisory work for all the plants of the corporation.

Kreston T. Sorensen, Newly Appointed Vice-president in Charge of Production, William Sellers & Co.


LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

***LAKE ERIE** Hydraulic Presses are serving America and her allies around the world. If you are in need of added Hydraulic Press capacities, you will find Lake Erie ready and able to do something about it.*

**LAKE ERIE ENGINEERING CORPORATION • BUFFALO 17, NEW YORK**

WILLIAM H. KRAMER, JR., has been appointed production manager of the Stover Lock Nut & Machinery Corporation, Easton, Pa. Mr. Kramer was for ten years previously in the production department of the Compressor Division of the Ingersoll-Rand Co.

WYCKOFF STEEL CO., Pittsburgh, Pa., announces the acquisition of the properties of the EMPIRE FINISHED STEEL CORPORATION located at Newark, N. J., and Putnam, Conn.

THURLOW E. MCBRIDE has been elected vice-president and treasurer of the American Engineering Co., Philadelphia, Pa.

FRANK E. TIGHE, superintendent of the Lansdowne, Md., plant of the Westinghouse Electric & Mfg. Co., and FORREST S. MABRY, section engineer of the company, have been awarded the Order of Merit—the highest honor that the company confers on its employes—for "outstanding work in designing and manufacturing Radar."

## Wisconsin and Missouri

ALLEN-BRADLEY CO., Milwaukee, Wis., announces that FRANK D. POPOWICS, who has been associated for many years with the Electrical Division of Colt's Patent Firearms Mfg. Co. in Chicago, Ill., is now a member of the New York sales engineering staff of the Allen-Bradley Co. C. N. CALKINS is district manager. CHARLES M. MCCOOMBS, formerly New England district manager for the Bull Dog Electric Products Co., has joined the Allen-Bradley sales engineering staff in Boston as assistant to M. H. HALLENBECK, district manager.

FRANK C. ANGLE, manager of sales activities in the Pacific region for Allis-Chalmers, Milwaukee, Wis., has just been appointed manager of all Allis-Chalmers field sales offices of the General Machinery Division. He will continue to supervise operations in the Pacific region. Mr. Angle was appointed manager of the Pacific region in 1943, and previous to that, was manager of the Allis-Chalmers San Francisco office.

KENNAMETAL, INC., Latrobe, Pa., has opened offices at Kansas City and St. Louis, Mo., both of which are under the direction of H. B. WEEKS, manager at Chicago, Ill. RALPH H. CRAIG has been placed in charge of the Kansas City office, and LYLE H. WADE heads the St. Louis office.

FREDERICK K. LOVEJOY has been appointed manager of the Kansas City district sales territory for American Machine and Metals, Inc., East Moline, Ill. The headquarters of the Kansas City office are located in the Midland Building.

# Coming Events

OCTOBER 2-5 — Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Netherland-Plaza Hotel, Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

OCTOBER 5-7 — Aircraft Engineering and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Biltmore, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

OCTOBER 5-7 — NATIONAL ELECTRONICS CONFERENCE at the Medinah Club, Chicago, Ill. B. Dudley, secretary, 520 N. Michigan Ave., Chicago 11, Ill.

OCTOBER 12-14—Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at Syracuse, N. Y. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit 8, Mich.

OCTOBER 16-18 — Seventeenth annual meeting of the INSTITUTE OF METALS AND THE IRON AND STEEL DIVISIONS OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS at the Statler Hotel, Cleveland, Ohio. For further information, address American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York 18, N. Y.

OCTOBER 16-19 — Annual meeting of the AMERICAN WELDING SOCIETY in Cleveland, Ohio. Secretary, Miss M. M. Kelly, 33 W. 39th St., New York City.

OCTOBER 16-20 — Twenty-sixth annual meeting of the AMERICAN SOCIETY FOR METALS AND THE NATIONAL METAL CONGRESS, to be held at the Public Auditorium, Cleveland, Ohio. W. H. Eisenman, secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 17-20 — Fall meeting of the Society for Experimental Stress Analysis at Carter Hotel, Cleveland, Ohio. W. M. Murray, president, P. O. Box 168, Cambridge 39, Mass.

NOVEMBER 2-3 — Eighth annual NATIONAL TIME AND MOTION STUDY CLINIC at the Medinah Club, Chicago, Ill., under the auspices of the Industrial Management Society. Further information can be obtained from the vice-president of the Society, C. S. Becker, 205 W. Wacker Drive, Chicago 6, Ill.

NOVEMBER 13-14—Fall meeting of the AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION at The Homestead, Hot Springs, Va. Thomas A. Fernley, Jr., executive secretary, 505 Arch St., Philadelphia 6, Pa.

NOVEMBER 15-19 — THIRD NATIONAL CHEMICAL EXPOSITION in the Chicago Coliseum, Chicago, Ill. M. H. Arveson, chairman Exposition Committee, American Chemical Society, 330 S. Wells St., Chicago 6, Ill.

NOVEMBER 27 - DECEMBER 1 — Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Hotel Pennsylvania, New York City. Clarence E. Davies, secretary; 29 W. 39th St., New York 18, N. Y.

NOVEMBER 27-DECEMBER 2—SIXTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING in Madison Square Garden, New York City. For further information, apply to Charles F. Roth, president, International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

JANUARY 8-12, 1945—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Further information can be obtained from John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

* * *

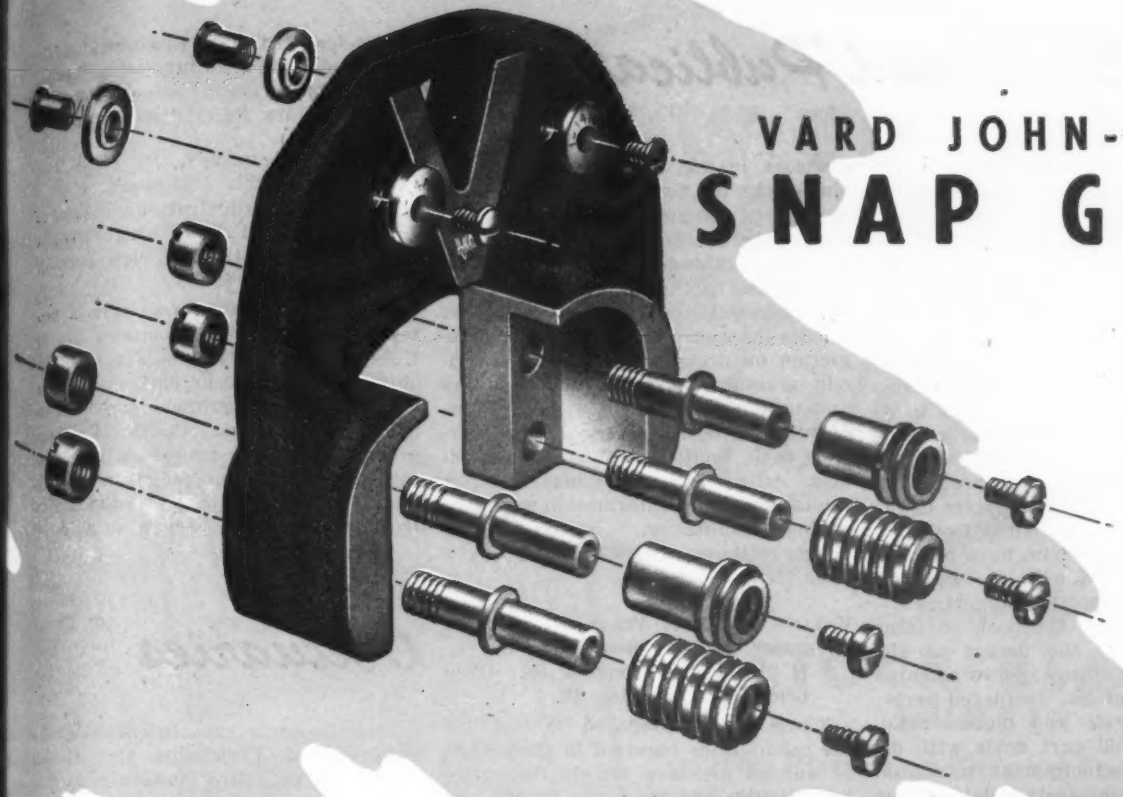
## Getting Employe Cooperation

Awards have just been made to fifteen employes of the Lincoln Electric Co., Cleveland, Ohio, as winners in a post-war planning competition for Lincoln employes. The amount distributed was $4750, the largest prize being $1000, which was won by Jim Nicholl, foreman of the shipping department, who submitted a paper on deep-drawn, automatically welded steel containers for export packing and shipping of electrodes. In all, 161 papers were submitted in the competition, the object of which was "to gather all of the ideas of each employe to assist the management in planning for the future."

* * *

## Harnischfeger New Welding Film

"New Horizons in Welding" is the title of a 16-millimeter sound film, prepared by the Harnischfeger Corporation. The film, which takes thirty minutes to present, deals primarily with the set-up for production welding, picturing the step-by-step procedure followed when welding is used on a high-speed, mass-production basis. This film is available to groups of manufacturers, trade schools, Government departments, etc., on application to the Harnischfeger Corporation, Welding Division, 4400 W. National Avenue, Milwaukee 14, Wis.



# VARD JOHN-SONS SNAP GAGE

This is an exploded view of a VARD precision thread gage. This gage can explode your inspection costs if you are still checking external threads with a pair of ring gages.

In one quick operation, threaded work on the bench or in the machine can be gaged for lead, thread form, pitch diameter, straightness and roundness.

Correctly cut threads pass through the GO rolls—are stopped by the NO GO rolls.

Write for literature today.

**CHECK EITHER RIGHT OR LEFT HAND THREADS WITH THE SAME GAGE.**

- Rotating rolls reduce wear.
- Eccentric pins permit adjustment.
- Meehanite, hand fitting frame.
- Open end gage frame permits checking threads to a shoulder.
- Lock nuts secure gage setting.

VARD JOHN-SONS ROLL THREAD SNAP GAGES ARE MADE IN SIZES TO GAGE WORK FROM NO. 0 TO 12-IN. DIAMETER, AND IN ALL STANDARD THREAD FORMS.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**VARD INC.** *PASADENA 8, CALIF.*

# New Books and Publications

HANDBOOK ON DESIGNING FOR QUANTITY PRODUCTION. Prepared and edited by Herbert Chase. 517 pages, 5 1/2 by 8 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $5.

It is the purpose of this book to provide engineers and engineering students with information on designing for quantity production, definite suggestions being given as to what to do and what to avoid doing in designing a part, so that the part can be produced to best advantage by high-production processes. The various chapters in the book have been contributed by different writers, all of whom have been intimately associated with the work involving their respective subjects.

The first part of the book contains specific rules for the design of die-castings; sand castings; screw machine products; stampings; die-forged parts; cold-headed parts; and plastic moldings. The second part deals with designing for production at minimum cost. It gives comparative data on the cost of making various types of products by different processes or methods, which should aid the designer in choosing the type of design best adapted for economical manufacture in particular cases.

THE EXTRUSION OF METALS. By Claude E. Pearson. 205 pages, 5 1/2 by 8 1/2 inches; 142 illustrations. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $3.75.

The process of extrusion has achieved, within a short period of time, a major revolution in the methods of metal working. Comparatively little information has been available in the past on this subject. The author has, therefore, endeavored to present a comprehensive treatise covering the various phases of the subject. The book contains ten chapters headed as follows: Historical Survey; The Extrusion of Lead and Other Soft Metals; The Extrusion of Lead Cable-sheathing; Equipment for the Hot Extrusion of Hard Metals; Flow in Metals during Extrusion; The Pressure of Extrusion; Metals and Alloys for Hot Extrusion; The Properties of Extruded Metals; Impact Methods of Extrusion; and Some Special Applications of the Extrusion Process.

SEAMLESS STEEL TUBE DATA. 320 pages, 8½ by 11 inches, loose-leaf binder. Published by the Seamless Steel Tube Institute, Pittsburgh 19, Pa. Price, $2.50.

This book on tubing is divided into four principal sections covering general data on tubing, mechanical tubing, pressure tubing, and reference tables. Under the heading of "General Data" is a brief summary of the history, manufacture, tests, etc., that apply to seamless tubing. The section on mechanical tubing covers typical uses, with suggestions on how to obtain best results through the use of tubing. The section on pressure tubing gives various pressure formulas, specifications and tolerance tables for various types of tubes used in industry. The reference table section is unusually extensive, with many formulas, weight tables, and other information useful in tubing application. Supplementary sheets with new data will be issued from time to time.

KYLIN'S PRESSURE VESSEL TABLES. 21 pages, 6 by 9 inches. Published by H. Kylin, 11 Everett St., Cambridge, Mass. Price, $3.

These tables, prepared to simplify the calculations required in the design of unfired pressure vessels for petroleum liquids and gases, are based upon the codes of the American Society of Mechanical Engineers and the American Petroleum Institute. The book contains tables and formulas pertaining to shell thickness, and flanged and dished heads. It covers a wide range of pressures and diameters. The data should be found useful by engineers and designers whose work requires them to perform calculations relating to pressure vessels.

FUNDAMENTALS OF MECHANICAL INSPECTION. By Roland Jenkins. 179 pages, 5 1/4 by 8 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $1.75.

This little handbook covers the "how" and "why" of inspection. It is intended for men who are being trained to become inspectors, as well as for junior inspectors. After reviewing the purpose and intention of inspection, the principles and uses of fine tools and precision instruments are discussed. The author, who is inspection supervisor of the Sperry Gyroscope Co., has had extensive practical experience.

ENGINEERING PAPERS—FOURTH ANNUAL CONTEST. Published by the Hydraulic Institute, 90 West St., New York 6, N. Y. Price, $1.50 plus postage.

The book is the outgrowth of the Hydraulic Institute's contests, held annually, covering the theory, design, and practical application of pumps. The subjects covered in this volume are: Special Operating Conditions of Centrifugal Pumps; A Common Language for Hydraulic Engineers; Critical Speed; Direct-Acting Steam Pumps; and Effect of Entrained or Dissolved Gas on Rotary Pump Performance.

CHEMICAL MACHINERY. By Emil Raymond Riegel. 583 pages, 6 by 9 inches, 436 illustrations. Published by Reinhold Publishing Corporation, 330 W. 42nd St., New York 18, N. Y. Price, $5.

The author of this treatise is a professor of industrial chemistry at the University of Buffalo. In this book his object has been to prepare an elementary treatise on equipment used in the process industries. Considering the great number of processes involved, the author has succeeded in preparing a comprehensive and informative treatise covering a very wide field.

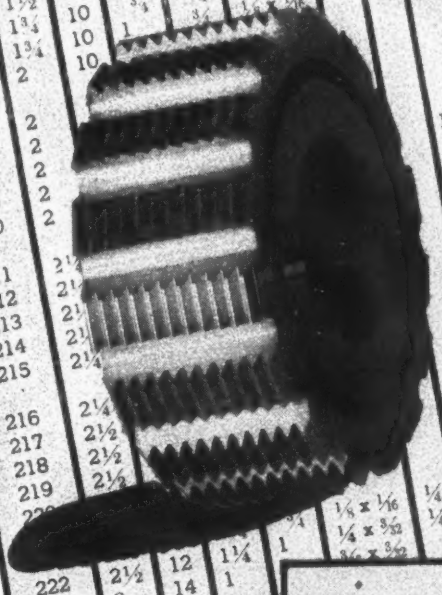
# Obituaries

JOHN BROUWER, superintendent of the Gallmeyer & Livingston Co., Grand Rapids, Mich., died suddenly at his home on September 10, after having completed his usual duties on the previous day. He was sixty years of age. Mr. Brouwer was born in Saugatuck, Mich. He moved to Grand Rapids at an early age, and has been active in the machine tool industry over a period of many years. He became affiliated with the Gallmeyer & Livingston Co. as superintendent at the time the company was organized in January, 1923, after having been associated with the Oliver Machinery Co., Wilmarth & Morman Co., and Grand Rapids Grinding Machine Co. in various capacities.

EDWARD A. LONG, one of the oldest distributors of machine tools in Boston, died on August 24 of pneumonia, after an illness of several months, at the age of sixty-three years. Mr. Long started work with Hill, Clarke & Co. of Boston in 1900. Later he was sales manager for the Whitcomb-Blaisdell Machine Tool Co. of Worcester and the Factory & Mill Supply Co. of Boston. For the last ten years he had been in business under the name of the Long Machinery Co.

HARRY BARNEY, president of the Barney Machinery Co., of Pittsburgh, Pa., died on September 6 at the Mercy Hospital in Pittsburgh, following a long illness. Mr. Barney was well-known among machine tool distributors. He was born in Tiffin, Ohio, sixty-five years ago, and attended the public schools of Cleveland. After starting in business with the Manning, Maxwell & Moore Co., he organized his own machine tool distributor company in 1911. Mr. Barney was unmarried; he is survived by three sisters and a brother.

# HOW TO GET THREAD MILLING CUTTERS *Faster*



## Order by STOCK BLANK NUMBER

**giving Pitch and Thread Form desired**

**DETROIT**

**STANDARD STOCK BLANKS MEET 90% OF ALL THREAD MILLING CUTTER REQUIREMENTS**

## SHELL TY

| List No. | Diameter A | No. of Flutes B | Face Width C | Hole Size D | Keyway E |
|---|---|---|---|---|---|
| 201 | 1½ | 8 | ½ | ⅝ | ⅛ x 1/16 |
| 202 | 1½ | 8 | ¾ | ⅝ | ⅛ x 1/16 |
| 203 | 1¾ | 10 | ¾ | ¾ | ⅛ x 1/16 |
| 204 | 1¾ | 10 | 1 | ¾ | ⅛ x 1/16 |
| 205 | 2 | 10 | | | |
| 206 | 2 | | | | |
| 207 | 2 | | | | |
| 208 | 2 | | | | |
| 209 | 2 | | | | |
| 210 | 2 | | | | |
| 211 | 2¼ | | | | |
| 212 | 2¼ | | | | |
| 213 | 2¼ | | | | |
| 214 | 2¼ | | | | |
| 215 | 2¼ | | | | |
| 216 | 2¼ | | | | |
| 217 | 2½ | | | | |
| 218 | 2½ | | | | |
| 219 | 2½ | | | | |
| 222 | 2½ | 12 | 1¼ | 1 | ¼ x 3/32 |
| 223 | 3 | 14 | 1 | 1 | ¼ x 3/32 |
| 224 | 3 | 14 | 1 | 1 | ¼ x 3/32 |
| 225 | 3 | 14 | 1¼ | 1 | ¼ x 3/32 |
| 226 | 3 | 14 | 1¼ | 1¼ | ¼ x 3/32 |
| 227 | 3 | 14 | 1¼ | 1¼ | ¼ x 3/32 |
| 228 | 3 | 14 | 2 | 1¼ | ¼ x 3/32 |
| 229 | 3 | 14 | 2 | 1¼ | ¼ x 3/32 |
| 230 | 3 | 14 | 2 | 1¼ | ¼ x 3/32 |
| 231 | 3 | 14 | 2 | 1¼ | ¼ x 3/32 |
| 232 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 233 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 234 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 235 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 236 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 237 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 238 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 239 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |
| 240 | 3½ | 16 | 2 | 1¼ | ¼ x 3/32 |

## SHANK TYPE

| List No. | A Diameter Thread Section | B Number of Flutes | C Width of Face | D Length of Shank | E Length Overall | F Shank Diameter Large End | G Shank Taper: Jarno | G Shank Taper: Brown & Sharpe | G Shank Taper: Morse | H Drawbar Threads |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | | | | 3 11/16 | 5¼ | .884 | 7 | | | ½-13NC |
| 102 | | | | | 5½ | .922 | | 8 | | ⅝-24NF |
| 103 | | | | | | | | | 3 | ½-13NC |
| 106 | 1 | | | | | | | | | ½-13NC |
| 107 | 1¼ | 8 | 1½ | | | | | | | ½-13NC |
| 108 | 1¼ | 8 | 1½ | 4⅞ | 6¼ | | | | | ⅝-24NF |
| 109 | 1¼ | 8 | 1½ | 3⅜ | 5½ | .948 | | | | ½-13NC |
| 110 | 1½ | 8 | 1½ | 4 11/16 | 6¼ | 1.134 | 9 | | | ½-13NC |
| 111 | 1½ | 8 | 1½ | 4⅞ | 6¼ | 1.271 | | 10 | | ⅝-24NF |
| 112 | 1½ | 8 | 1½ | 3⅜ | 5½ | .948 | | | 3 | ½-13NC |

***FOR STANDARD STOCK SIZES, ASK FOR BULLETIN No. CB-43***

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